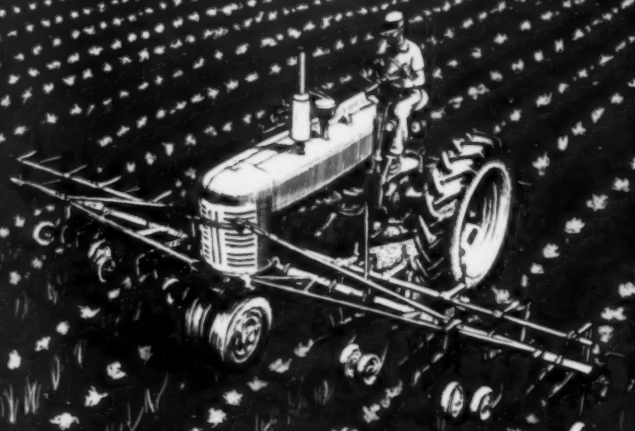
AUGUST 1960

RESEARCH and DEVELOPMENT news edition

Product Engineering



TODAY'S *plowshares...*

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PRE-DEVELOPMENT PLANNING: FOUR STEPS TO LOW-RISK PRODUCTS

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DESIGN FOR PLANTKEEPING *page 34*

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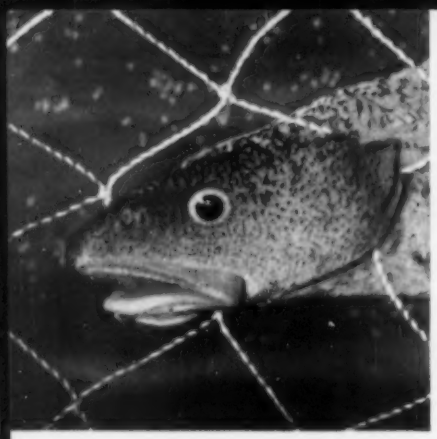

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coming next week . . . the DESIGN edition

for August 18

FEATURING:

- **Selecting polyphase motors**
  Tables match load characteristics with motor design for torque, slip and duty cycle.

- **Stop the backlash in spring clutches**
  Two simple spring modifications will do what tightened tolerances can't.

- **Fluid power in machine-tool controls**
  When to choose hydraulic over electrical power for control and actuation.

- **Refining metals in vacuum**
  The various vacuum refining methods for turning out purer and stronger castings.

- **Statistics for material specifications**
  Three-step procedure helps producer and user to get together to reduce rejects.

- **11 universal shaft-couplings**
  Couplings which combine both axial and angular play.

- **The conjugate-beam method**
  For fast analysis of load problems.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news edition

August 11, 1958 Vol. 29, No. 32

FEATURED:

TODAY'S PLOWSHARES. Machinery takes over the farm jobs. Six-row equipment is becoming standard; power ratings have doubled; versatility is emphasized by a large selection of attachments 19

PRE-DEVELOPMENT PLANNING—Four steps to low-risk products. These steps should precede product acceptance; it will narrow the choice to those few ideas with better-than-average chance for success 32

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Product Engineering . . . . SIDELIGHTS

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● **This week's cover,** designed for "Today's Plowshares" (p. 19), was inspired by the photo at right. Waving his artistic license, our art director (a city boy) changed the furrows somewhat to produce a better cover design. The result: What appears to be a pronounced dip in the field and a farmer who completely disregards all the best precepts of contour plowing.

● **A survey of 600 researchers** and technically trained people at duPont turns up some thought-provoking statistics: 88% are married (85% for general population); they average a little over 2 children per family (1.5 for average US family); approximately 75% list church as an activity (61% of general population are church members); 36% participate in civic activities, 19% in community organizations, 8% in politics, 7% in fund-raising groups, 22% in musical groups, 70% in 42 different sports (golf, bowling, fishing, lead the list). These are our eggheads—68% have doctorates, 73% of their wives attended colleges. Are they "dangerous elements" or, because of their training, do they accept an even greater social responsibility?

● **Subliminal projection** got a heavy blow recently as a result of research done by Dr. C. H. Lawshe and J. C. Naylor of Purdue. After a careful review of some 50 experiments in subliminal perception and defense they conclude: "Until someone can demonstrate in an experiment which has complete and adequate controls that subception exists, the concern of many seems slightly premature." We breathed a sigh of relief and happily went to our first movie in nearly a year—neved did like soda pop.

ABP AUGUST 11, 1958 **Product Engineering** *A McGRAW-HILL PUBLICATION* Vol. 29, No. 32 ABC

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PLASTICS IN ELECTRICAL DESIGN

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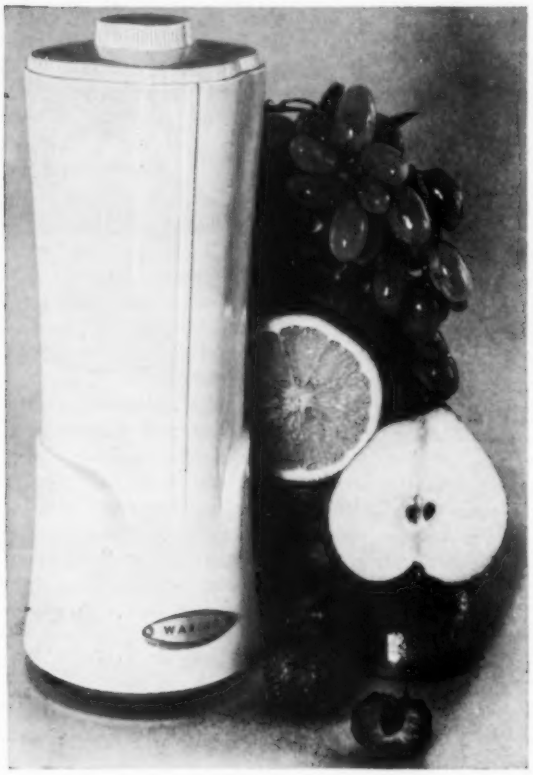

Conceived as both mixer and server of beverages and sauces, the new Waring Drink Mixer serves graciously anywhere in the home. In accord with the need for style, portability and economy, the mixing cavity, motor housing, handle and pouring spout are molded in one unit of CYMEL 1077 melamine molding compound—familiar to consumers in popular MELMAC® dinnerware. This styling in CYMEL keeps down size, weight, and cost. CYMEL provides insulation, strength, resistance to heat and staining, excellent stability, low moisture absorption, permanent rich molded-in color and hard surface.

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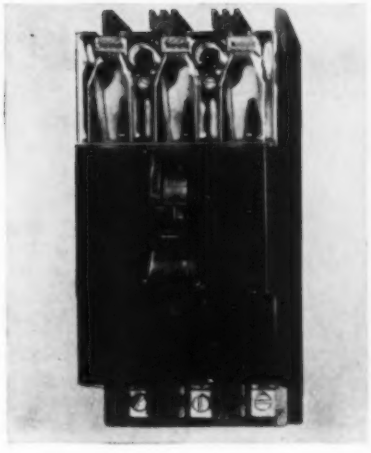

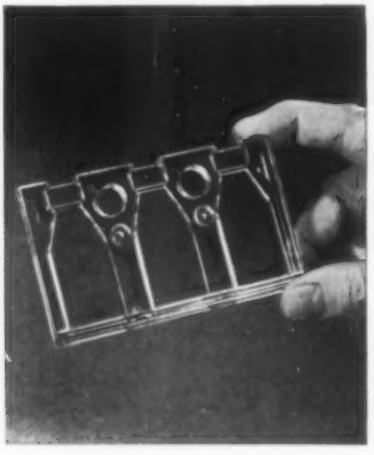

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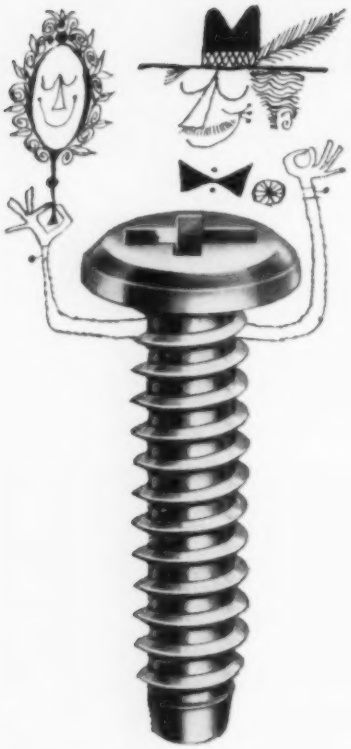

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READER TO EDITOR

Cultivating Creativity

To the Editor:

Mr. Lichtgarn's statements in "Can You Spot a Creative Engineer?" (*PE*—June 16, p. 30) are 100% correct, as I have learned from observation and experience. It seems most unfortunate that in this age of virtually life-or-death scientific rivalry we not only do not fully encourage our creative scientists and inventors but all too often we actually seem to penalize them for pioneering efforts. As Mr. Lichtgarn points out, the average personnel man is no more capable of judging true genius than the man in the moon. Most of them operate by rote and if a really creative and "different" person comes along the personnel specialist is lost. Creativity is being widely advertised but, apparently, no special effort is being made to discover it nor to put it to fullest use after it may be found more or less by accident. In view of the dangerous scientific pace set by our rivals I am wondering whether we can continue such a policy.

There is a need for reorganizing our research and invention setup and to provide a system under which our highly original innovators can be discovered and utilized. The disclosure of inventions should in no way be dependent upon an inventor's financial status; his rights should be protected. —A. G. Thomas
Butler, Penna.

To the Editor:

Since Mr. Lichtgarn points out the difficulty employers have in recognizing the qualities of the not-too-common creative engineer, the writer suggests that such engineers might be recognized as are fruit trees, namely, "By their fruits ye shall know them"!

Through a medium such as Product Engineering, the employer could expose his unsolved problem, using the best answer as a resumé for employing the creative engineer he obviously needs. —R. W. McKirdy
President
Mutual Electronic Industries Corp.
Irvington-on-Hudson, N. Y.

To the Editor:

Perhaps personnel men and engineering administrators will be able to use this lesson better when, and if, industrial management decides to encourage the engineer-inventor in an honorable manner for mutual benefit. This would be by royalty incentive rather than month-by-month salary, along with the tolerance mentioned. Quoting Ralph Waldo Emerson:

"The inquiry leads us to that source, at once the essence of genius, of virtue, and of life, which we call Spontaneity or Instinct. We denote this primary wisdom as Intuition, whilst all later teachings are tuitions."

—W. E. Greene
Los Angeles, Calif.

To the Editor:

Having interviewed and hired many technical people during the past fifteen years, I can appreciate the full implication of what Mr. Lichtgarn has said with reference to spotting creative people. There are two points, however, that I would like to add:

1. Beware of the man who presents a sloppy appearance and manner as a badge of genius! Many a Chief Engineer still smarts over the pseudo genius, bohemian he once hired—and didn't fire soon enough.

2. Just as important as recognizing creative talent, are the problems that employers must face once they are so fortunate as to have hired such people. The employer needs to assure that the proper environment is provided—not the least of which is the best of communications between supervision and the creative worker. This requires a high level of maturity on the part of supervision in order that the necessary ingredients such as patience, understanding and respect are exhibited; while channeling the creative person's efforts along lines beneficial to the employer.

—Charles Krill
Librascope Inc.
Burbank, Calif.

Bumper Crop

To the Editor:

Just what got into the minds of the bumper boys in Detroit and I do mean bumpers. The rassel tassel of chrome protrudes, projects, and reaches out from the front and the rear to defeat any purpose of protection. If the Detroit designers are not satisfied with quicker obsolescence and beat-up sheet iron, probably they could devise a modular system of additives to counteract competitive protrusions and projections.

—H. E. Watkins
Chicago, Ill.

DEVELOPMENTS TO WATCH...

Thermal insulation twice as efficient . . .

. . . as any previously used is claimed by Frigidaire for its newest refrigerator-freezer combination (*PE—June 2, p. 5*). It's a Freon-urethane combination that can be foamed in place; Frigidaire engineers say it's so efficient that about 1½ in. does the work of 3-in. conventional insulations. This allows the usable interior of a refrigerator to be increased as much as 50% with the same outside dimensions.

Advantage of using Freon is obvious: it has already proved compatible with other refrigerator materials.

Power sources of the future . . .

. . . are making real progress. At a recent Symposium on Unstable Chemical Species in Los Angeles, speakers described three new ways to produce free radicals (microwave discharge, modulated atomic beam, and particle bombardment using a Tesla coil discharge) and a new way to obtain a shock-free stream of ions for ion propulsion tests (*PE—Feb. 24, p. 14*).

The ion stream is produced by a low-temperature electric discharge that dissociates the molecules of a gas. The gas is then allowed to expand through a supersonic nozzle, providing a nonthermal stream suitable for both aerodynamic and physical studies.

These techniques—and others discussed at the meeting—are still in the laboratory stage, of course, with plenty of work still to be done. As Dr. R. J. Sunderland of Aerojet-General told the conference:

"Ionically propelled space vehicles will require total ion currents ranging from several hundred to several thousand amperes. The source of these ions must be capable of continuous operation for periods extending to several earth-years . . . and, ideally, the unit must be flexible enough to allow the current to be varied over a wide range, and light enough so that the complete source contributes only insignificantly to the total mass of the powerplant."

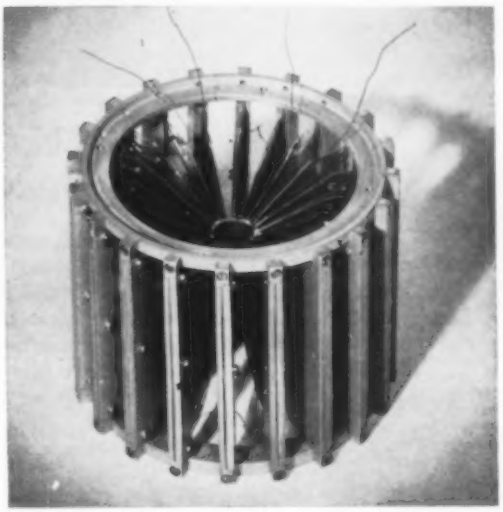
Thermoelectric generator with nuclear battery . . .

. . . as heat source is being developed by Monsanto engineers at the AEC's Mound Laboratory.

In its present stage of development, the unit has an initial output of 120 milliwatts at 11.6 volts and an overall power conversion efficiency of 0.5%. However, output and efficiency decrease as activity of the isotope decreases. In the current model, using polonium 210 as the heat source, output drops to 50 milliwatts at 6 v and efficiency to 0.3% after six months. Other isotopes, with different half-lives, would, of course, show different reduction curves.

As described by T. G. Linxweiler of the Research Div, the generator consists of 20 thermopiles, radially spaced around a cylindrical heat source (see photo). Each thermopile contains 37 thermocouples connected in series. The hot junctions of the thermocouples are aligned along one edge of a thin mica card, and the cold junctions on the opposite side; hot ends in contact with the heat source.

As Linxweiler emphasizes, these generators are still far from general commercial use—particularly in view of the current high cost of isotopes that appear suitable. However, isotope prices are being reduced, and unusual power sources like this may justify their cost in special jobs. (*PE—May 12, p. 72.*)



Novel power source is this thermoelectric generator designed by Monsanto engineers. Thermocouples are installed on radially arranged mica cards. Isotope goes in the tube at the center; and electrical connections are made at the outside. —ARG

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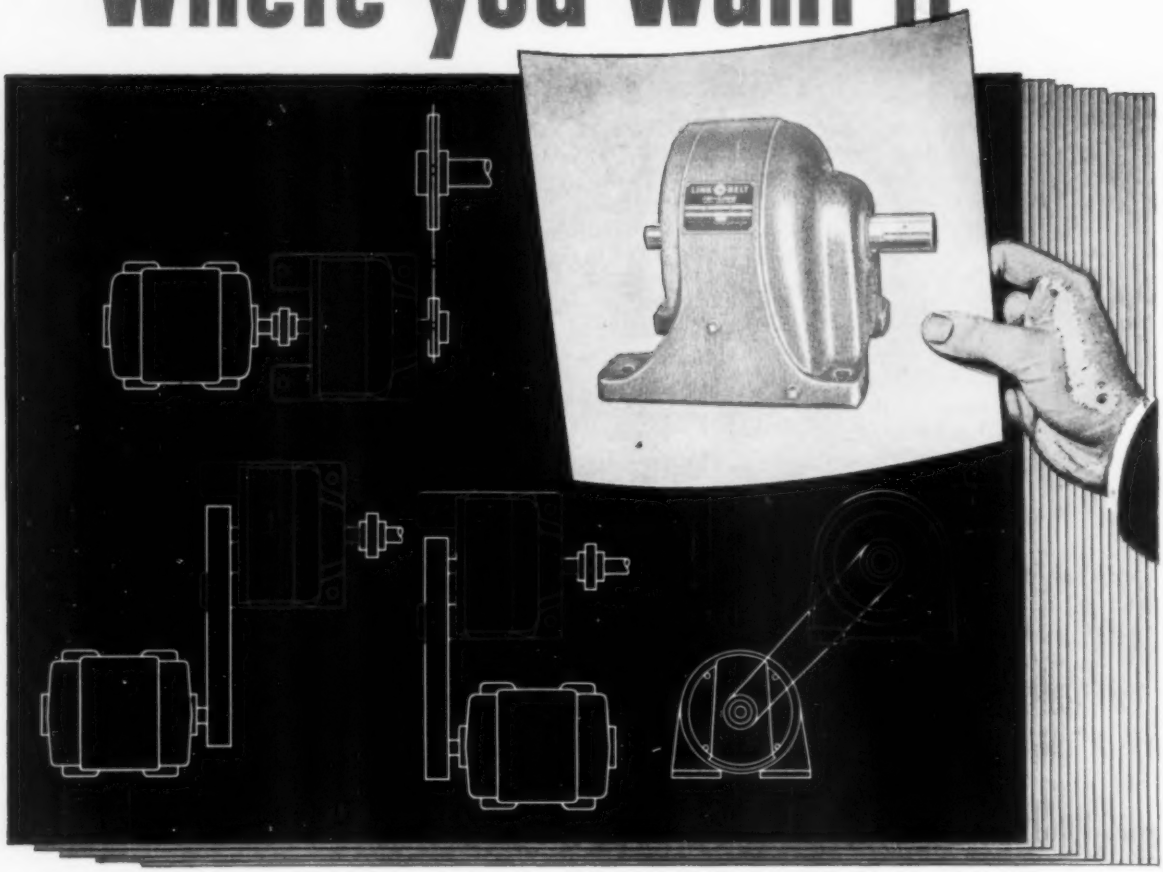

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DEVELOPMENTS TO WATCH...

Reliability of new weapons . . .

. . . is coming under Congressional scrutiny–particularly ballistic missiles. Recently, the House Appropriations Committee quietly set up an evaluation board of Government and industry experts to see if the nation is getting its money's worth on the multibillion-dollar defense budget.

The legislators are concerned over the results of some of the big "spectacular" missile firings–failures are occurring too often, they say. The committee report is due to be completed by December. Congress will use it in revaluing policy on future budget requests for missiles, R & D and production.

Dr. William A. Wildhack, physicist at the National Bureau of Standards, heads up the evaluation board. Other members include: Dr. Clifford C. Furnas, Chancellor of the University of Buffalo and former Assistant Secy. of Defense; Dr. Harry Goode, University of Michigan; Julian West, Bell Laboratories; and others of similar background.

A suite of offices in the Pentagon has been turned over to the group. Reportedly, Secy. of Defense McElroy has ordered that Wildhack and his staff be given full access to data and officials.

The legislators spelled out three key questions for the evaluation board to answer:

What is wrong with the Vanguard project and should it be continued; what is the current status of the competing Army Jupiter and Air Force Thor IRBM's and should both programs be continued or the better one substituted; what is the status of other military missiles and rockets, and should any be cancelled, speeded up, etc?

A central source for translations . . .

. . . of Russian technical information will soon be available. Congress approved $510,000 for the Dept. of Commerce's Office of Technical Services (OTS) to set up a clearing-house operation. Commerce wanted $1 million to handle the job. If the operation proves successful more money will likely be pumped into the program.

Initially, the OTS is publishing a list of some 200 translated documents on hand. Starting next month, however, it will offer abstracts of some 141 technical journals–on medicine, physics, engineering, etc–either on an annual subscription or individual purchase basis.

The clearing house will not make translations itself, but will gather them from other sources–primarily Government intelligence agencies. It expects to process around 50,000 abstracts and 10,000 complete translations a year.

A list of available Russian documents will be published monthly in the US government research report put out by OTS. By next January, however, the clearing house hopes to have a separate monthly index just for translated material. A list of foreign translations currently available can be obtained free from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

Changes in reliability monitoring . . .

. . . of missile weapon systems will probably start pouring out of the Pentagon. A 15-man industry-military committee has completed a broad-gage study and come up with some definite recommendations.

The committee proposes to require reliability checks at major points in weapon-system development–during detailed design study, at the pre-prototype stage, prototype, pre-production demonstration, demonstration of service readiness, service evaluation, full-scale production, and during demonstration of major production improvement.

"Reliability is a parameter that can be predicted, assessed, measured, and controlled" during these stages, the committee reported. And it laid much military expense and delay directly to failure in having an adequate reliability-monitoring setup.

Right now, there is wide diversity among the Services on how to monitor reliability–or major components and the system itself–during the development stages of a missile system. In many projects, there's continuous monitoring–the services keeping track as the project goes along.

The committee, however, thinks that work should come to a halt at designated stages. The idea is to let both the military and the contractor take a good look periodically at the program. Obviously, this wouldn't work with some crash programs. But for most military work, the committee thinks such a system would be a dollar and time saver.

World-wide ...

DEVELOPMENTS TO WATCH...

Nonmetal flexible heating element . . .

. . . for home appliances, plastic-laminating and molding machinery, agricultural equipment, and other industrial applications, has been developed in England. This graphite-coated glass fiber mesh, made for service at temperatures to 380 F, is being offered in resistances from 6 to about 100 ohms per unit square, for loadings between 20 and 300 watts/sq ft. Voltage may range from 2 to 250.

Hunting Mhoglas Ltd., Luton Airport, Bedfordshire, quotes prices ranging from the English equivolent of 76¢ down to 54¢ a sq ft (depending on quantity) for material up to 1 ft wide and 3 ft long.

New aluminum alloys and fabrication methods . . .

. . . are busting out all over, to quote a popular song.

From Austria comes news of an alloy that can be made entirely from high-zinc scrap, shows high strength without heat treatment, and has good castability. Its basic recipe, says the Austrian Foundry Institute, Leoben, Styria, is: 10% Zn, 8% Si, 0.35% Mg; balance, Al.

From Aluminum Ltd. of Canada comes a new extrusion alloy for structural members that's said to offer better mechanical properties, better finish, and faster extrusion speeds than any now available.

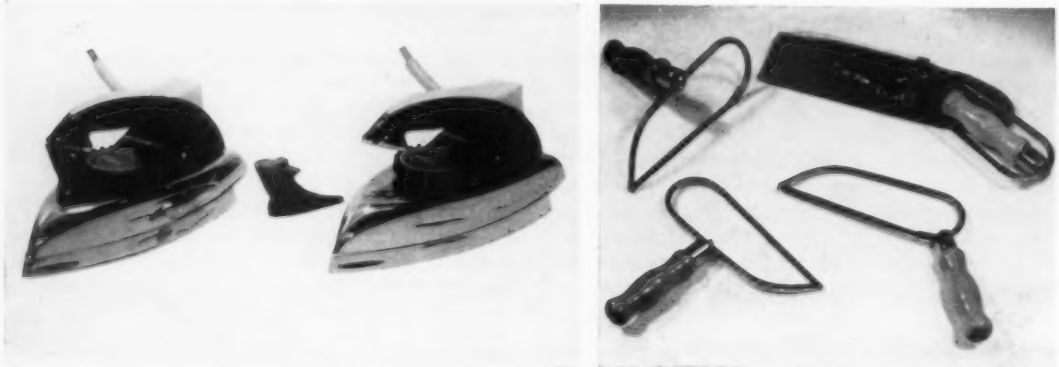
In the US, Kaiser Aluminum and Chemical reports a high-purity casting alloy "combining high tensile and yield strengths with good ductility after heat treatment, plus all the desirable foundry characteristics, including castability, machinability, dimensional stability, and resistance to corrosion." And all this, says Kaiser, "at only a small premium in price." Named X357, it's an aluminum-silicon alloy with mechanical properties "within range of the wrought structural alloys 6061 and 5086."

Aluminum fabrication isn't being neglected, either. Alcoa, for instance, recently reported a "pressure bonding" process that can join forged or wrought aluminum to carbon or stainless steel, copper, and other alloys. First use is in an electric fry pan in which an aluminum outer shell is joined to an inner stainless-steel shell body.

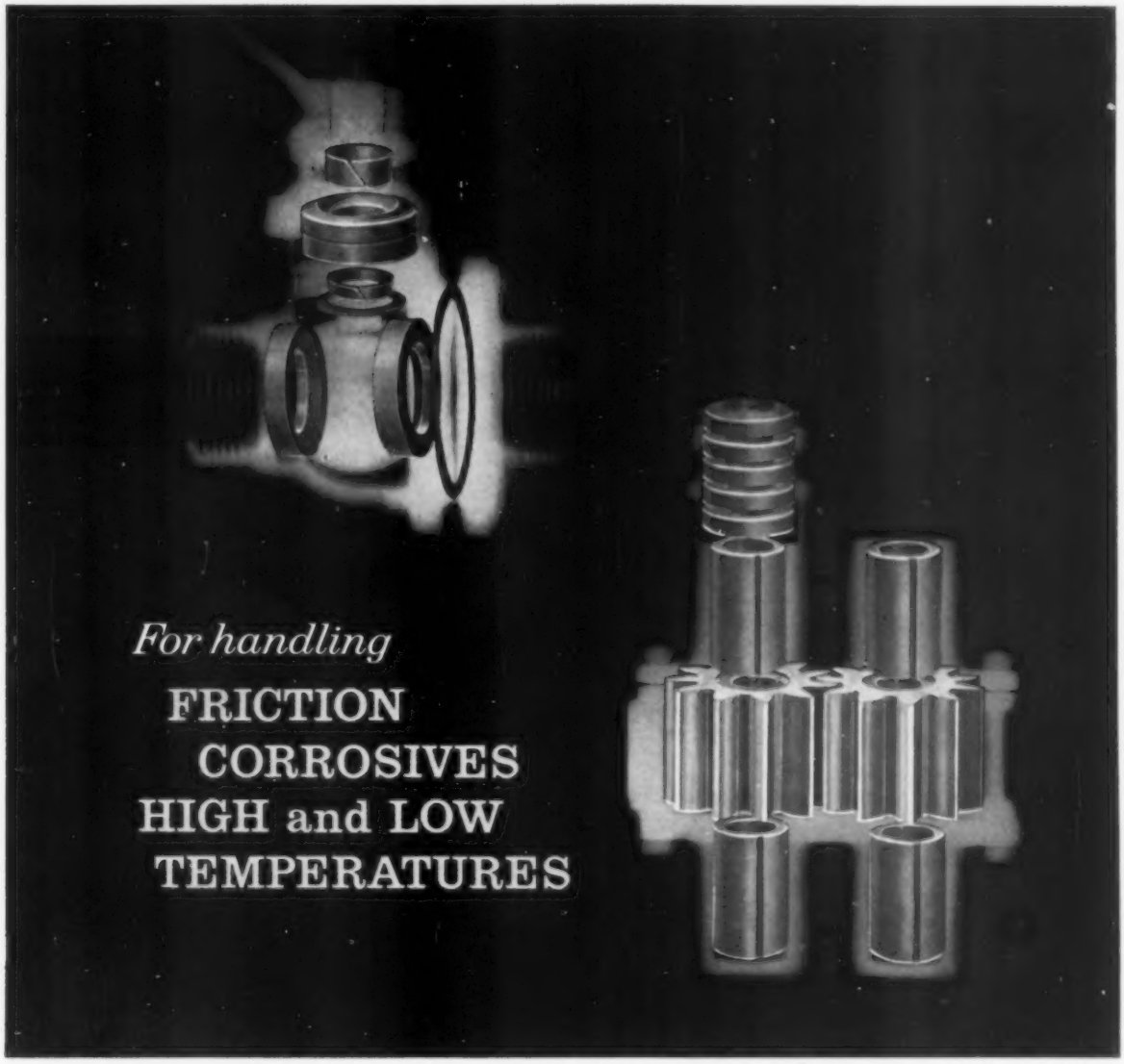
Handle design is getting a lot of attention . . .

. . . from West German engineers, as these two pictures indicate. The electric iron features a built-in headlight and a removable handle section (to simplify pressing of sleeves, pockets, and other hard-to-reach spots). The hand saw is so designed that the handle can be positioned at any point along the frame; and, as the photo indicates, the complete unit can be collapsed into a space-saving package. The saw, made by Josef Haunstetter Saegenfabrik, Augsburg-Goeggingen, is to be sold through US mail-order houses.

The electric iron, produced by Elektra GmbH, POB 351, Hagen/Westf., is also seeking American distribution.



Electric iron and hand saw show German attention to handle design. Both will compete with US products.



X-RAY photos show typical uses of Du Pont TFE resins . . . seals in chemical valve and bearings in gear pump.

Here's why seals and bearings of TFE-fluorocarbon resins may be your solution

TFE-fluorocarbon resins have the lowest coefficient of static friction of any solid substance known. Under high loads, coefficients lower than 0.016 have been measured. The resins have practically universal chemical inertness and are rated for continuous use at temperatures from −450° to 500°F.

TFE BEARINGS can operate dry in assemblies where lubrication is difficult or impossible. *As in the pump shown above, which handles hydrogen peroxide, ethylene oxide, hydrazine, they* perform unharmed and keep products free of contamination by lubricants. TFE bearings can be tailored for high loads, high velocities or high wear resistance by the use of reinforced constructions.

TFE SEALS are not damaged by vicious chemicals or temperature extremes. *As in the valve shown above,* their low surface friction makes for low torque, easy operation, perfect release from metallic contact. TFE fluorocarbon seals are available in all basic designs and configurations.

DISCOVER how you can improve your products and processes with seals and bearings of Du Pont TFE-*fluorocarbon* resins. For product *and design* information see your local supplier. Look *for him* under "Plastics—Du Pont" in the Yellow Pages or write to: **E. I. du Pont de Nemours & Co. (Inc.), Room PE2524, Nemours Building, Wilmington 98, Delaware.** In Canada: Du Pont Company of Canada (1956) Limited, P.O. Box 660, Montreal, Quebec.

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TFE-FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

What's happening in SCIENCE

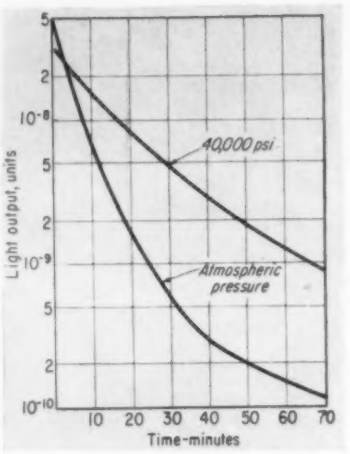
Pressure brings new light

What happens to a phosphor or semiconductor when you put on the pressure? Does output of light increase or decrease? Can a mechanical force affect light output at all?

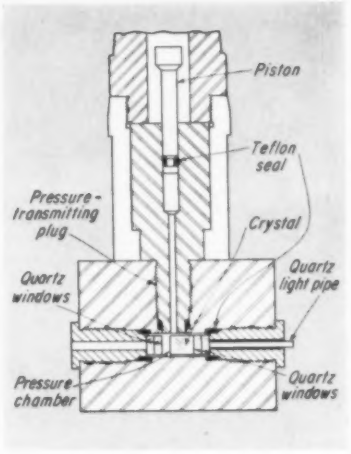
In the vast literature on semiconductors and luminescent phosphors, much has been said about the effects of temperature on performance, but almost nothing on the effects of pressure. Now, physicists at Armour Research Foundation are exploring this neglected avenue, and find pressure effects are considerable—and a valuable source of information about the phosphors themselves.

As L. Reiffel, manager of physics research at ARF points out, heat has a tendency to modify semiconductor performance in a way that minimizes asymmetries. Pressure, on the other hand, emphasizes asymmetrical phenomena, making them easier to detect and study. It seems to have a direct effect on the electron "traps" which permit and control energy-level changes and thus affect light output.

Research in this area seems well worth attention.



Irradiated phosphors show marked improvement in half-life (roughly, time to reduce light output by one-half) at 40,000 psi of hydrostatic pressure, as compared with normal conditions. Phosphor is thallium-activated sodium iodide.



Pressure chamber for ARF phosphor studies can maintain desired pressure automatically to an accuracy of about 1%. Temperature is also held constant, and provision is made to interrupt light beam and take "dark current" readings.

The most exotic fuel

We know a lot today about putting the sun's energy to work—in solar "cookers," radios, and even hearing aids. But these involve solar energy in the form of heat, or converting the light into electrical power. Direct use of light rays—of individual quanta or photons of light—is something else again. True, harnessing streams of photons from the sun and stars for propulsion—like rocket gases—sounds like Buck Rogers. But scientists around the world are taking it seriously—not only here but in the USSR (*PE—Feb.* 10, p. 14).

A report on the Soviet space effort, prepared by the Library of Congress, quotes one Russian scientist as saying that photon propulsion may become a reality within the next four decades. As he describes them, photonic rockets will depend on a stream of electromagnetic quanta reflected from the walls of a reaction nozzle. It sounds simple but, he points out, the difficulty is that even ideal reflectors absorb some of the radiant energy they receive. And, he says, "the magnitude and intensity of the photon stream required to propel a rocket is so great that the mirror would be vaporized in a fraction of a second if light of the visible spectrum were to be used." However, he believes the longer waves of the electromagnetic spectrum may get around this problem. "The lower energy quanta of centimeter waves," he says, "are absorbed by mirror surfaces to such a small extent that it becomes possible to use them for propulsion of photonic rockets."

atom briefs . . .

No thermonuclear reaction so far in ZETA, the British now admit. As predicted here (*PE—Oct.* 21, '57, p. 12), early optimism has been tempered by further tests indicating that neutrons coming from this "fusion machine" were machine-made, and not the result of energy-producing nuclear fusion. The British point out, though, that the Zeta experiments are nonetheless valuable, and they haven't given up hope. They're modifying Zeta and building new fusion machines that will, they are sure, do the trick before long.

Propulsion by nuclear explosion? It's an idea that's going to receive serious attention. Scientists at General Dynamics suggested using a series of controlled nuclear explosions as a means of propulsion through outer space; and the Advanced Research Projects Agency of the ARDC has given them a go-ahead—plus a million dollars—to explore it further.

Technical progress reviews, now being published on a regular basis by the AEC, cover scientific and technical developments of interest well beyond the nuclear field. Available on subscription ($2 a year each) from the Government Printing Office, Washington 25, D. C., these quarterlies are:

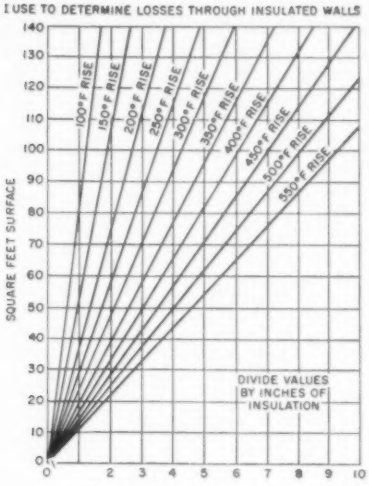
Power Reactor Technology
Reactor Fuel Processing
Reactor Core Materials

Single copies may be had from the same source for 55¢.

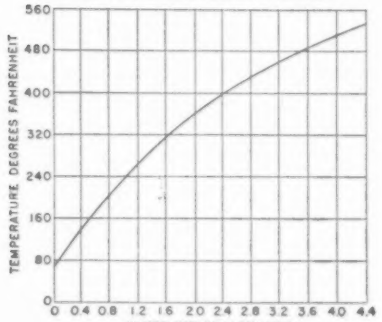
Also available: *Nuclear Science Abstracts*, issued twice monthly at a subscription price of $12 a year. Single-copy price varies. —ARG

How to choose the right amount of heat for ovens and process air applications

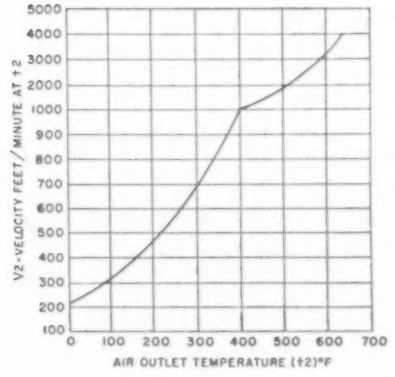
I USE TO DETERMINE LOSSES THROUGH INSULATED WALLS



II USE TO DETERMINE LOSSES FROM ENDS



III USE TO DETERMINE VELOCITY OF AIR



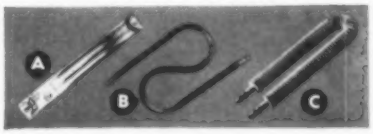
IV This Table Lists Specific Heats

Substance	Average Specific Heat	Weight in Lb per Cu Ft
SOLIDS		
Aluminum	0.23	160
Antimony	.052	423
Asphalt	.40	65
Beeswax		60
Bismuth	.031	610
Brass	.10	525
Brickwork and Masonry	.220	140
Carbon	.204	
Copper	.10	550
Glass	.20	165
Graphite	.20	130
Iron, cast	.13	450
Iron, wrought	.12	480
Lead, solid	.031	710
Lead, melted	.04	
Nickel	.11	550
Paper	.45	58
Paraffin	.70	56
Pitch, hard		83
Rubber	.40	95 ±
Silver	.057	655
Solder (50% lead—50% tin)	.04	580
Steel	.12	490
Sugar	.30	105
Sulphur	.203	125
Tallow		60
Tin, solid	.056	455
Tin, melted	.064	
Type metal (85% lead—15% antimony)	.040	670
Wood	.45 ±	34 pine 50 oak
Zinc	.095	445
LIQUIDS		
Acetic acid	0.472	66
Alcohol	.65	55
Benzine	.45	56
Ether	.503	46
Glue (mixed 2 parts water, 1 part dry glue)	.895	69
Glycerine	.58	79
Mercury	.0333	845
Oil, cottonseed	.47	60
Oil, machine	.40	58
Oil, olive	.471	58
Paraffin, melted	.71	56
Petroleum	.51	56
Sulphur, melted	.234	
Turpentine	.41	54
Water	1.0	62.5

	At Constant Pressure	At 70 F Atmospheric Pressure
GASES		
Acetylene	0.35	0.073
Air	.237	.080
Alcohol	.453	
Ammonia	.520	.048
Carbon dioxide	.203	.123
Carbon monoxide	.243	.078
Chlorine	.125	.20
Hydrochloric acid	.195	.102
Hydrogen	3.41	.0056
Methane	.60	.0447
Nitrogen	.245	.078
Oxygen	.218	.09
Sulphur dioxide	.155	.179

Here is condensed information to help you get the most economical electric heaters for your oven and process air design problems.

Generally, strip heaters (a) or tubular heaters (b) are used for natural convection applications. For forced convection heating, fin-tubular heaters (c) are most desirable.



Here's how you figure the amount of heat required:

1. Using the formula, lbs of material × specific ht × temp rise (F) over 3412 = kwh required, figure heat requirements for the conveyor.
2. Using the above formula, figure heat requirements for the material to be heat treated.
3. Figure total area, in square feet, of top, bottom and both sides of the oven. Check Table I to find total kwh losses. Adjust for insulation.
4. Figure area of both end openings in square inches. Multiply times factor found in Table II.
5. Figure in square feet, the area of the duct. Check Table I for losses. Adjust for insulation.
6. Figure cubic feet of volume of oven and duct. Find weight of air at room temperature from Table IV. Multiply your answer times total cubic feet times number of air changes needed per hour. With this answer, use formula from Step 1 above to find kw needed for air change losses.

Total the answer arrived at in the 6 steps above. Add 3 kw as a safety factor. You now know how much heat is required. For more complete information, send coupon below or call your nearest General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

Section B723-28, General Electric Co.
Schenectady 5, New York
Please send GEA-5096, "Heating Process Air" and GEC-1005, "Catalog of G-E Heaters and Devices."

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Our own glossary

III–Polymers in space

A new family of plastics made its debut not long ago–and, with it, a whole new group of descriptive terms that seems designed for much broader use. Among them: *stereospecific, isotactic, atactic,* and *syndiotactic.* All four relate to concepts of plastics structure, and especially to the spatial configuration of macro-molecules.

Most publicized use of these terms has been in connection with the polyolefin plastics (*PE—May 5, p. 16*), notably, the polypropylene resins introduced by Montecatini of Italy and its American representative, Chemore Corp. Here, as installment III of our continuing glossary of new terms in materials, is what these new words mean:

The "smallest" polyolefin, polyethylene, is a straight-chain carbon polymer that consists simply of a chain of carbon atoms to which are attached hydrogen atoms. It is a soft, relatively low-melting material (even in "high density" form).

As one moves up the polyolefin ladder, the molecules become more complex. In polypropylene, for instance, methyl (CH_3) groups as well as hydrogen atoms are attached to the carbon "backbone."

When it is assumed that the molecule is stretched out on a plane, and these methyl groups are all on one side of it, with the hydrogen atoms on the other side, the polymer is said to be *isotactic.* (Iso means "equal"; *taktikos,* "ordered" or "arranged.")

An **isotactic** polymer, then, is a carbon-hydrogen compound in which the side groups or radicals (CH_3, for instance) are all on one side of a plane in which it is assumed that the main chain of carbon atoms is stretched, and the hydrogen atoms are on the other.

A **syndiotactic** polymer is one where the radicals or side chains alternate with the hydrogen atoms on the two sides of the assumed molecular plane. (The prefix in this case indicates that the side groups are located *similarly,* appearing regularly on opposite sides of the carbon chain.) Syndiotactic polypropylene has not yet been made, but syndiotactic vinyl polymers have been achieved in the laboratory.

An **atactic** polymer is one that has no special arrangement of the side chains and hydrogen groups. They are randomly distributed around the assumed molecular plane. (The "a" in atactic comes from *ab,* "away from," so this literally means "away from order" or random.)

The interest in these spatial configurations stems from the fact that, by achieving the isotactic form at least, it seems possible vastly to improve the properties of the basic resin—particularly in regard to strength and heat resistance. It is hoped, too, that this research will pave the way for new rubbery materials and fibers. To this end, a search is on for new polymerization methods and particularly for catalysts which will create desired patterns in space. To such catalysts, the term stereospecific has been applied.

A **stereospecific** catalyst is a compound that makes a given monomer take on a desired spatial configuration when it is polymerized.

Although there has been much discussion in recent months of isotactic polymers and stereospecific catalysts, work on both is actually in its very early stages. New techniques, applied in higher-order carbon compounds should bring materials offering heat resistance in the 500- or 600-F range; or providing properties that will prove useful in fibers and finishes.

Why they're using the new plastics

Why bother with propylene and its isotactic polymers (see left) when there are already so many plastics on the market—and quite a few of them similar to this one? First reports from users provide the answers:

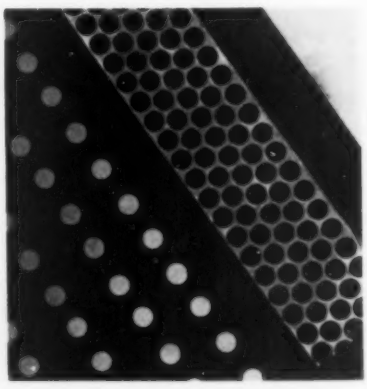
Improved heat resistance—even compared with "linear" polyethylene (*PE—Nov. 18, '57, p. 17*) is one.

Nalge Company, for instance, guarantees a softening temperature above 300 F for the cylinders, tubes, and laboratory funnels it is molding of isotactic polypropylene. Furthermore, say company engineers, the new material is a particularly good choice for parts that must be autoclaved because, at 250 F, polypropylene exhibits negligible shrinkage, while linear polyethylene may contract as much as 4%. In addition polypropylene shows good strength and is clear enough for liquid-level observation.

In fiber and rope form too, polypropylene is said to offer a number of advantages. Says Plymouth Cordage Co.: Polypropylene rope is significantly stronger, longer wearing, more heat resistant, and less slippery than linear polyethylene rope.

US suppliers of polypropylene plastics now include Hercules Powder Co. and Montecatini's American representative, Chemore Corp. The material is priced 10 to 20¢ a lb above polyethylene; but its improved physical properties may help to equalize product costs. —ARG

Moly makes a fine support for the tiny silicon and germanium wafers used in semiconductor devices (solar batteries, rectifiers, and the like), says Fansteel Metallurgical Corp; and it's ready to supply special pure molybdenum sheet, plain or nickel coated, or to provide the stamped disks themselves, as shown at right. As Fansteel points out, molybdenum has good thermal and electrical conductivity and retains its strength at elevated temperatures; and, while far from cheap, it's considerably less expensive than the semiconductor materials.



Miniature Directional Signal. A foraging bee brings home one drop of nectar. His fellow workers sniff it like bloodhounds, and from the scent know just where to go for more. This tiny droplet is nature's miracle for keeping bees on the beam.

Miniature Selector Switch. Missiles stay on course when controlled by complex selector switch. Two MPB bearings on its shaft make frictional torque practically negligible, keep total weight down to .42 ounce. It's a man-miracle in miniaturization.

Man With Miracles. This is Hank Eckert, one of MPB's Sales Engineers. He helped the selector switch people find exactly the right type of MPB radial retainer bearing to hold friction to a minimum, give dependable service and assure operating precision.

Designers' dream world Miracles in Miniaturization

BEARING ACTUAL SIZE

New Miracles. Today's industrial scientists are pioneering a whole new world of man-made miniaturization. With MPB miniature bearings and experience it is a wide, wide world on a tiny scale. For in miniaturization, bearings are one of the most critical considerations.

MPB makes miniature bearings ⅜" O.D. *down* (specials on request). In stock—over 500 types and sizes. Consult MPB when you are embarking on a miniaturization problem and/or write for new MPB catalog. **Miniature Precision Bearings, Inc.,** 208 Precision Park, Keene, N. H.

MPB

Helps you perform miracles in miniaturization

hi-fax®.. the high-density

Looking at high-density polyethylenes for improved products and lower costs? Then be sure to check Hi-fax.

Here's why Hi-fax is different:

Hi-fax, as produced by Hercules' exclusive process is different in nature and performance from all other high-density polyethylenes. It is formulated at a density which provides optimum performance in terms of the key properties you need.

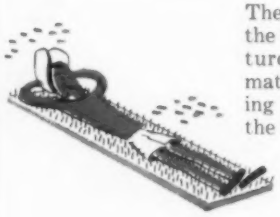
Different because: Temperature Resistance

From boiling water to sub-zero temperatures, Hi-fax retains its dimensional stability, flexibility, and impact strength. Non-toxic, too, it's the ideal plastic for housewares, containers, toys, and food packaging.

Different because: Lightweight

Providing rigid strength in thin-wall sections, Hi-fax, lightest of all high-density polyethylenes, yields extremely lightweight, highly functional structures.

Different because: Rigidity



The stiffness of Hi-fax permits the design of thinner wall structures, substantially reducing material costs without sacrificing appearance or function in the end product.

Different because: Toughness

Unbreakable and abrasion-resistant, Hi-fax provides a sturdy, low-cost plastic for heavy-duty industrial applications, mechanical uses, pipe, wire and cable, film and paper coatings.

Different because: Stress-Crack Resistance

No other high-density polyethylene can match the stress-crack resistance of Hi-fax. This key property makes Hi-fax the preferred polyolefin in detergent packaging, wire and cable coatings, and any other uses where resistance to embrittlement due to atmospheric or chemical exposures is important.

HERCULES

THREE NEW MATERIALS FOR THE PLASTICS INDUSTRY

Hi-fax High-density polyethylene • Pro-fax® Polypropylene

Penton® Chlorinated polyether

*Hercules trademark

polyethylene that's different

Need a custom-built high density polyethylene exactly tailored to your market?

Only Hi-fax gives you a choice of 7 end-use types.

1. Injection Molding

A broad selection of injection molding types offering the optimum in physical properties, moldability, color and finish in four different melt index ranges.

Royal insulated jug has base, cap and handle molded with Hi-fax by Avsco Inc., Excelsior Springs, Missouri.

2. Blown Containers

The only high-density polyethylene especially formulated for blow molding. Produces lightweight, thin-wall containers with outstanding heat, chemical, and stress-crack resistance.

Another first for Hi-fax! Thermoplastic syrup jar at left molded by Royal Manufacturing Co., Prescott, Arizona, for Maynard Manufacturing Co., Glendale, California.

3. Pipe

An exclusive Hercules formulation, based on more than three years of laboratory and field testing, designed to yield better plastic pipe at lower cost.

Hi-fax can be fabricated in conventional equipment, yields uniform wall thicknesses even in large diameter pipe.

4. Extrusion

Your choice of four extrusion grades specifically formulated to provide the combination of physical and mechanical properties required in your process and products.

By using Hi-Fax tubing in its sash balance assembly, Unique Balance Company makes an already fine product an even better one. Extruded by Keystone Plastics Inc., Newark, N.J.

5. Wire and Cable

Three special grades providing outstanding abrasion and stress-crack resistance, the two properties most important to the electrical industry.

Hi-fax produces low-cost plastic-coated tree wire capable of withstanding rugged, long-term exposures to abrasion and weathering.

6. Film and Paper Coating

Special grades with excellent workability, acceptable for direct contact with foods, and yielding low-cost films and paper coatings.

7. Monofilament

Resins which yield rope, cordage and fabrics with excellent "hand" and "feel", high tensile strength, abrasion resistance, flexibility and washability.

Cellulose Products Department

HERCULES POWDER COMPANY
INCORPORATED

900 Market Street, Wilmington 99, Delaware

Need a Fastener that Hasn't Been Invented?

Chances are you'll pay top price for it. But by following these six rules you can avoid the high cost of becoming an inventor!*

IT'S natural to assume that, after designing a piece of equipment, you'll have no trouble finding standard fasteners to fit it. Usually such fasteners will be readily available. But what happens when you find yourself with a finished design that doesn't lend itself to any known fastening method?

The most expensive thing you can do at this point is to start inventing fasteners. Valuable man hours go into research, design, prototypes and testing. And unless you can make these fasteners in very large quantities the unit cost will be high, particularly if tooling is necessary.

Now, here are six tips that can get you out of trouble—and keep you out:

1. Remember—not all standard specialty fasteners are listed in fastener manufacturers' catalogs. The fastener company that serves you is probably tooled up for hundreds of non-standard devices, designed and produced to solve problems like yours for other customers. Maybe one would meet your requirements. You'd save the development and tooling charges.

2. There may be a stock fastener available for this job that hasn't come to your attention. Discuss the problem with the fastener manufacturer. If he has nothing in stock, he may be able to modify one of his standard devices at very nominal extra cost.

3. Don't overlook free professional help! Your fastener manufacturer will be glad to offer advice and design service—he does it for everyone else. Unload the problem on him, and let his experience work for you.

But you'll save money if you avoid specifying the fastener that hasn't been invented. By following the next three rules you can usually keep from reaching the point where a non-standard device might be necessary.

4. Go into the fastening problem during the early stages of design. Design your closures with standard fastenings in mind. You won't be left with the costly choice of inventing a fastener or redesigning your product.

5. Keep a complete file of fastener manufacturers' catalogs. Your product designers seldom are fastener specialists too, but they can have complete information available when they need it—at the design level.

6. Work closely with the Fastener Sales Engineer who calls on you. He's trained and paid to help solve your problems. Take full advantage of this service.

Whether you need a standard specialty fastener or the one that hasn't been invented, Southco is well qualified to invite your inquiries. There's no obligation on your part. It's part of our business to offer free consultation at the design or production levels, on items of your own product line, or on those involving military specifications.

Send today for our forty-four page Fastener Handbook No. 8, just printed. Write to Southco Division, South Chester Corporation, 236 Industrial Highway, Lester, Pa.

* *Reprints of this page are available on request.*

SOUTHCO

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FASTENERS

DARERS go first

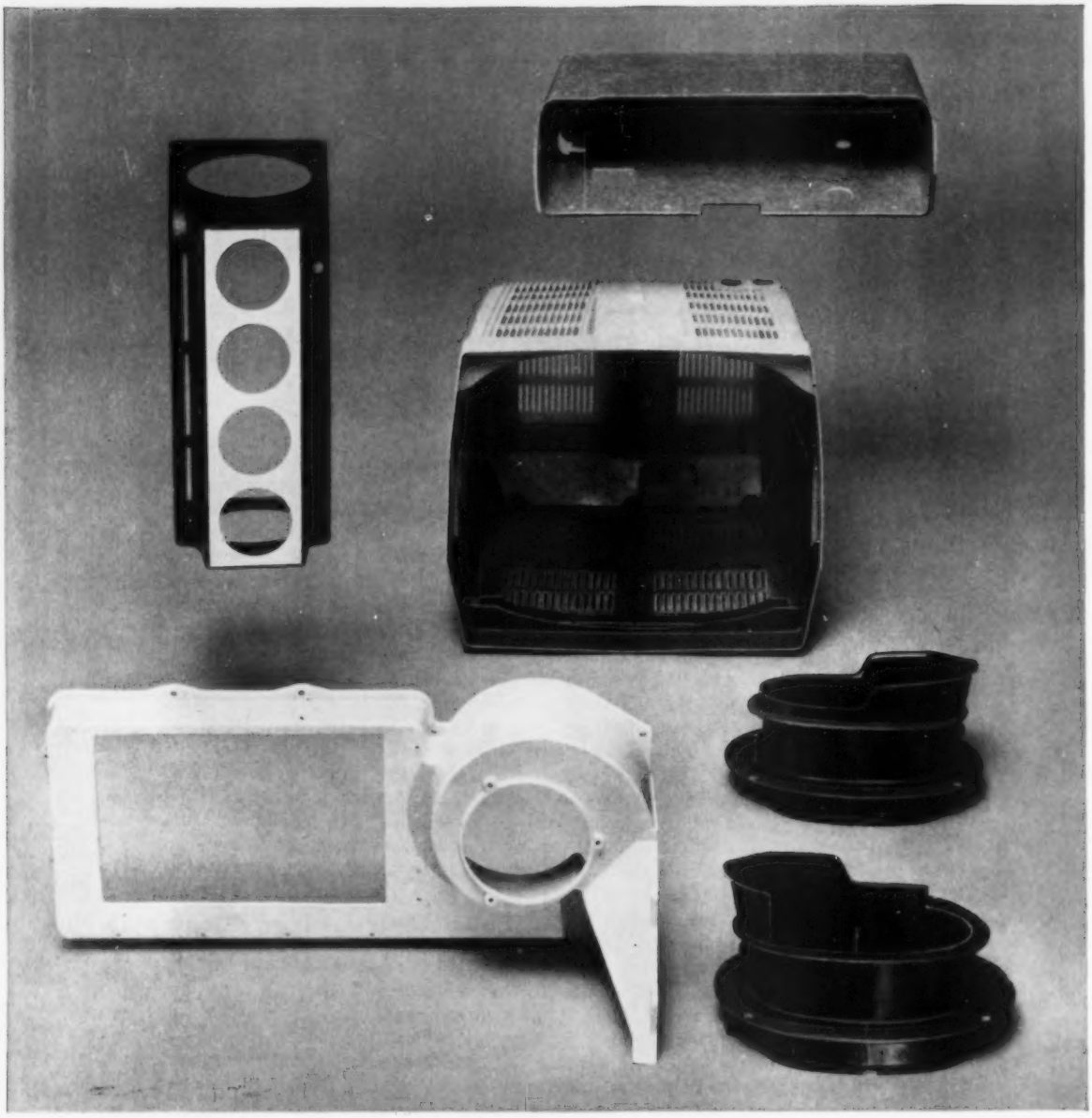
It's surprising how frequently children's games provide the exact pattern for what is supposedly a very grown-up event. Take leapfrog, for instance. The Soviet Union leapfrogged us on guided missiles and sputniks, and is presently leaping over some of the intermediate steps in other developments. One is to go from a 2-engine transport to a jet, leapfrogging the 4-engine plane. Another is to go from no machine tool of a given type to one that combines all the best Western features and more, regardless of patents.

We've had our calamity howlers who deduce from these cases that the Soviet Union has surpassed us in everything technical. But these prophets of doom never played leapfrog. Remember that the leader must "assume the angle" (which we may well have done), that the leaper gets his spring from the back of the front man.

In many recent non-sputnik advances, the USSR has leapfrogged, based on our previous developments. Put the USSR in the lead, and suddenly her engineers won't move so fast. There's no clear-cut path, no one ahead to make the breakthroughs. If the Soviet Union does get ahead, we can do some leaping of our own by using their technology.

Let us not forget, by the way, that what applies internationally also applies on the company level. One breakthrough—or patent—doesn't provide permanent protection here either. Leapfrogging can be done at this level too. In a recent West Coast speech is a wry story that illustrates it. A semiconductor maker produces a germanium diode that solves a computer problem. It's difficult to make, so supplies are limited. The buyer—a computer producer—soon has orders that outstrip his supply of diodes, so he seeks alternate sources. Other manufacturers, seeing a market and knowing that the breakthrough has been made, get into the business. Soon there are half a dozen, and they can supply more than the buyer needs. Then the price falls until some suppliers get out. Meanwhile all are taking a loss. In one case like this, price dropped from $2.25 in 1954 to $0.50 now—down 80%.

It seems that everybody leaped in this case—and into the same hole. Somebody might have hunted added outlets, or hunted a new breakthrough, or picked his own market to develop. Somebody might have gone on instead of waiting for the someone else who dared to go first.



Wide range of premix moldings by the Plastics Division of General American Transportation Corporation includes: automotive air conditioning cabinet for D. A. Sutton Corp., Inc.; Silvertone portable TV cabinet for Sears, Roebuck and Co.; air duct and glove compartment for a leading automobile manufacturer; vending machine air duct for Vendo Co.

Premix moldings give you all three... quality, economy, versatility

Like to market better products and cut costs at the same time? Then premix moldings are for you!

When resins and reinforcing fibers are blended beforehand, more complex molds are not only possible but completely practical. Slots, grooves, holes, bosses and parts with varying wall thicknesses can be formed right in the mold. And whether the part is simple or complex, you'll get moldings with uniform strength and wall thicknesses. Premix moldings are improving products and cutting costs for a wide variety of industries using strong, rigid, reinforced plastics.

Molders across the nation rely on Dow Vinyltoluene and Dow Styrene for top-quality premix moldings. They can help you to better products at lower costs. For the names of molders and suppliers, contact your nearest Dow Sales office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Plastics Sales Dept. 2206K-1.

YOU CAN DEPEND ON DOW

Today's Plowshares: Bigger, More Versatile

Farms are fewer but larger. Improved design of equipment is making the farmers' operation more efficient. Say limit reached in use of automatic controls.

NEW YORK—In 1940 American farmers owned 13,932,000 horses and mules and 1,545,000 tractors; in 1956 they owned 3,962,000 horses and mules and 4,810,000 tractors. Machinery is taking over farm jobs.

Economics is part of the explanation. Wages paid hired farm labor have gone up nearly 20% since 1950, and other operating costs—feed and seed, taxes, repairs on buildings—are increasing. At the same time, prices farmers are getting for their crops are dropping. The Dept. of Agriculture index of prices received by farmers for all agricultural products (1910-14 = 100) dropped from 258 in 1950 to 236 in 1955, and though now rising is still below 1950.

These pressures are driving many farmers out of business. In 1940 there were 6.1 million farms; in 1954 only 4.8 million. The ones that survive are on the average larger and more efficient. For 1940 Dept. of Agriculture statistics show 100,531 farms with more than 1000 acres; in 1954, there were 130,481.

RAISING ROWS

For today's big farms, six-row equipment for planting, plowing, and cultivating is replacing four-row equipment; ten years ago two-row equipment was standard. Gas tanks and fertilizer hoppers are larger to cut the number of refill stops a farmer makes in a day. For example, the gas tank of Ford's Powermaster tractor now carries 17 gal.

In the past 15 years, tractors have about doubled in power. Engine displacement has increased and efficiency improved. International Harvester has just introduced its first six-cylinder tractor rated 54 drawbar hp, 60 belt hp and 72 engine hp.

Machines do many jobs at a time, and tractors accommodate a variety of machines. Corn pickers pick corn, husk it and deliver it to an attached bin. International Harvester recently demonstrated an experimental hay pelletizer that processes hay into disks or small cylinders in a form more appetizing for livestock. A combine made by J. I. Case Co. harvests both grain and soybeans when equipped with a conventional header, and can be equipped with a special header to shell corn.

A Ford Implement tractor engine is designed for conversion to LP gas or diesel changes and a few new parts. Implements are designed to fit several tractor models without modification. On the new Allis-Chalmers wheel tractors for cultivating and harvesting, rear-wheel spacing can be altered by the operator without leaving his seat.

The farmer today will buy a radical design, if it will increase his efficiency, and he will replace major implements every three or four years if the new designs offer significant improvements. While he does not generally respond to styling obsolescence, a Ford source points out that compact, clean functional design offers a sales advantage.

Operation comfort is getting more attention: cigarette lighters as well as power steering are available on many new tractors. Seats fold out of the way so the operator can drive while sitting or standing; or seats can be elevated for dusty driving. Closed cabs offer protection from weather, dust.

Major design goals in current R & D projects include: increased speed and power of tractors without increase in weight or cost; more traction from rubber-tired wheels without excessive weighting; tractors that fold up to pass through gates; methods of attaching implements for maximum weight transfer and traction without sacrificing quality of work; tractors with fewer moving parts, and more easily repaired by the farmer in the field.

SPEEDING THE FARMER TO THE FIELD

Implements used to be self-supporting and bolted to tractors, now two or three-point hitches are standard with prongs on the implement that slide into scabbard on the tractor. Hydraulically operated rubber-tired wheels lift harrows off the ground so they can be carried over paved roads without disconnecting.

Most equipment in the field is con-

Free-piston turbine . . . powers an experimental Ford tractor. Gases are exhausted to a 6-in.-dia. turbine rotor. Turbine transmits power through gear-reduction system to hydraulic pumps, cooling fan, fuel pumps, and drive shaft.

Torque-converter drive . . . developed by J. I. Case automatically adjusts power and speed to the work load. Operator also has standard gear drive available through a control on the steering wheel.

Hillside automatic leveling . . . both fore and aft and from side to side keeps this combine operating at full capacity on slopes up to 37%. This International Harvester combine also has power steering and individual wheel brakes.

Baler with a power plant . . . handles 200 bales an hour. It has an extra-wide pickup, sweep fork and auger feeding; ties 120-lb bales with either wire or twine.

trolled hydraulically. Combines designed for hilly locations include a hydraulic leveling device to keep the machine level on a slope.

A source at Ford Implement says automatic controls have about reached their limit. Farmers, he explains, want manual controls so they can set tractors for the speed needed by load conditions. There is little interest in automatic transmissions.

Hydraulic torque converters, however, are being adopted. In the Case-O-Matic tractors introduced last fall, the operator has a choice of standard multiple-gear drive, or torque-converter drive. Torque-converter drive includes eight forward ranges; engine speed is controlled by foot accelerator rather than load on the drawbar.

Pneumatic controls are rarely used, and electric drives are uncommon. While satisfactory as to weight, an electric drive costs more, requires more protection from rust and dirt, and is more difficult to repair.

GAS TURBINES

At present, the turbine is an uneconomical power source. Tractors do not ordinarily operate at full load, and no gas turbine is yet available that operates efficiently at partial load. Ford built an experimental free-piston turbine tractor (*PE—July '57, p. 154*) that has only three moving parts in the gas-generating section of the engine.

Easy hitching and unhitching . . . is possible with the two-point hitch on tandem disk harrow and plow at left. Operator backs tractor until sockets engage coupling beams.

Changes in agricultural practice are creating need for new types of equipment. More corn planting today is done by the wheel-track method, with planting done in depressions left by the four wheels of the tractor. This eliminates disking otherwise needed in preparing a rough plowed field for planting, and requires only a special axle on the tractor.

Liquid fertilizers and anhydrous ammonia need specially designed dispensers. Spray equipment is needed for weed prevention. A plastic mulch now under test, if found practical, will need special equipment to apply it and also to remove the plastic material when it is no longer needed.

SEEK NEW MATERIALS

New materials offer no present promise to revolutionize equipment design. Aluminum is still too expensive for extensive use, as is stainless steel. However, International Harvester is making considerable use of nodular iron.

Faster and larger equipment has promoted a switch from plain bearings to nylon, or to large ball bearings and roller bearings. Fiberglass is used for some fertilizer hoppers. IH applies a phosphate coat as a metal preparation before painting to improve paint adhesion. Regional bias favors design in certain instances because of crops and climatic conditions. A West Coast engineer with Allis-Chalmers notes that farmers in his area prefer crawler tractors where land is irrigated, wheels compact the soil to form water channels in the wrong places.

Large Western farms use larger equipment than elsewhere; 18-ft disk harrows are preferred to standard 10-ft, and 24-in. harrow blades over standard 18-in. blades. Western farmers insist on lights for tractors since much work is done at night to avoid daytime heat. Vegetable cultivators in the West must provide clearance for taller crops.

Major companies are deep in R & D. International Harvester says the tooling costs for its new line of tractors ran over $22 million. IH has not yet calculated costs of engineering, but say they usually run higher than tooling. Small companies, such as Hopper Machine Works of Los Angeles, see a market for custom equipment not provided by large manufacturers who concentrate research on equipment for soil preparation, planting, fertilizing, weeding, dusting and spraying where the sales potential is largest. But many special designs are needed for harvesting: some crops must be dug up, some shaken from the plant—and some carefully picked—an active area for the custom designer.

Remote-operated lifter . . . lowers rubber-tired wheels to transport this IH tandem disk harrow. The lifter is operated hydraulically through two hoses connected to the tractor's hydraulic system.

Hopper has a grape picker in early engineering stages which will require special planting and training of vines, but some growers are already anticipating availability of the harvesting equipment by planting vines for mechanical harvesting.

Aircraft Brake System to Save Weight, Wear

SEATTLE, WASH.—Taxi and flight tests of a new B. F. Goodrich liquid-cooled brake system have been completed on a Boeing 707 jet transport prototype at Boeing Flight Center here. "Brake noise, vibration or chatter, and sparks are eliminated with this system," said R. L. Sink, Goodrich project engineer. "Fluid circulating behind the friction surface of the brake absorbs heat and carries it out of the critical wheel and brake area into a liquid-to-liquid heat exchange. The cooled fluid then is returned to

the brake to absorb more heat and repeat the cooling cycle."

The brakes operate at temperatures considerably less than 500 F., as compared to 1300-1500 F for conventional disk brakes under similar braking conditions. The reduced temperature is said to lower the wear rate of the friction surface and reduce operating cost. When designed as an integral part of the aircraft, the new brake system will result in a weight saving.

Battery-operated Train Tested in Scotland

ABERDEEN, SCOTLAND—A battery-powered train is being tested here on the Aberdeen-Ballater branch of the Scottish Region of the British Railways. The train consists of two coaches with a total seating capacity of 117 passengers. Distance between the two cities is 43 miles, with a maximum gradient of one in 68.

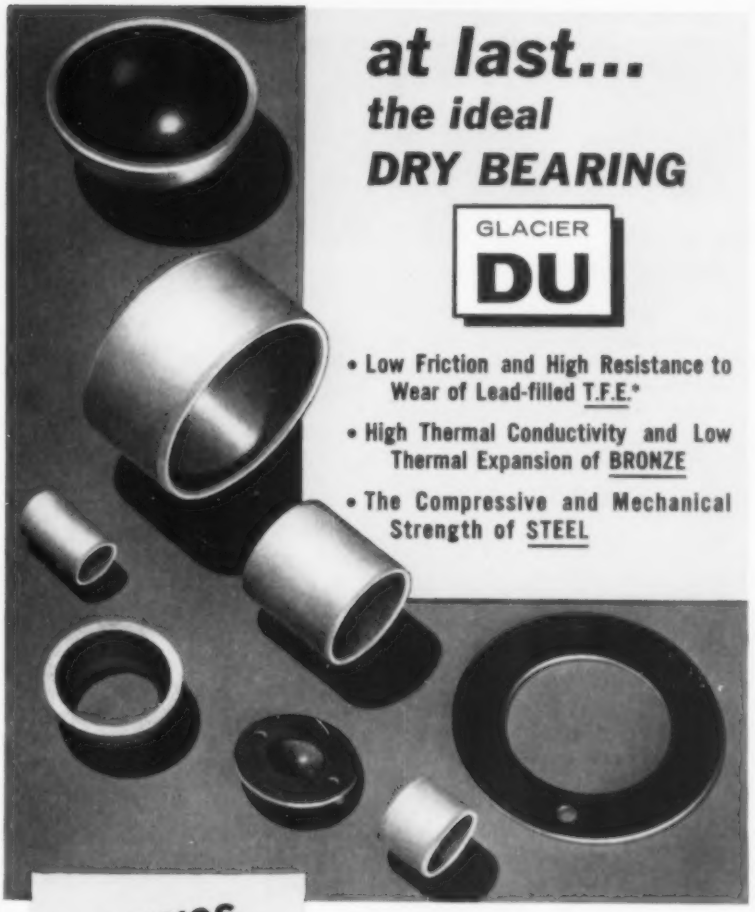
According to the railroad, should the experiment prove successful, the concept will be extended to other secondary lines in Scotland which are at present operating at a loss and would otherwise shut down.

The battery, which is arranged in cradles under each coach, consists of two sections, each weighing 8 tons, and with 216 lead-acid cells. The battery has a nominal voltage of 440 v with a storage capacity of 1,070 ampere-hours.

Battery-charging equipment is at each end of the line and designed to charge at a high rate while the train is standing in the station. Because of the high charging rate, considerable heat is generated in the electrolyte. To keep the battery cool, blowers circulate the air through the battery compartments.

TOP SPEED 50 MPR

Although the maximum permissible speed is 50 mph, maximum speed is well over 60 mph. Design permits an acceleration of 0.75 mph/sec up to 30 mph, which is considered ample in view of the many stops. For a smooth acceleration cam-operated contactors are driven by an electric motor whose speed is automatically regulated by the traction motor current. The two traction motors are rated at 100 kw each and are of the nose-suspended type, driving the axles through single spur gearing.



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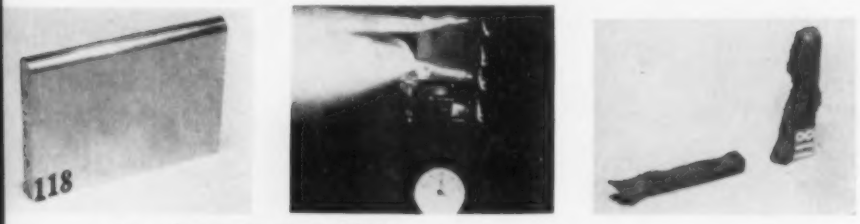


In rocket exhaust at 4400F . . .
this uncoated stainless steel specimen, left, was immersed in 4400 F, hot rocket exhaust, center, during Cornell Aeronautical Lab experiment seeking to improve design of high speed missiles that must fly for long periods in low-density atmosphere. After 20 seconds, specimen had been consumed to point illustrated at right. Gas velocity was approximately 4600 mph. Oxygen content was almost 5%. Over 96 different metals, plastics, ceramics and special coatings and shapes were tested by CAL under varying conditions of time, temperature, gas velocity and oxygen.

Three Fourths of Their Engineers in Lab

COLUMBUS, OHIO—An increasing need for near infinite reliability in aircraft and missile components is giving the engineer a bigger place in the organization of aircraft companies, it was asserted by Joseph F. Hill, chief engineer of Janitrol Corp.'s aircraft division.

He cited the missile and its growing complexity as evidence of this need. For example, he said, a missile of fairly complex design—with about 40,000 parts—would fail at least once in three tries if all components were subject to failure once in 100,000 times. Reliability cannot be obtained by using larger safety factors since this beefs up components and adds weight. The result is an increasing necessity for the designer to work between the two opposites—minimum weight and maximum reliability.

According to Hill, Janitrol's new plant typifies the organizational trend in the industry. Half its capital equipment and plant space are for test, development and other non-production purposes.

Some 25% of total personnel are assigned to engineering section; of engineering personnel, 25% are in design, 75% in laboratory.

Obsolescence quickly overtakes design as result of new developments. The engineer often will have to dig in new fields in order to complete a project.

Atmosphere entry simulator . . .
shown here is a new research device at the NACA Ames Aeronautical Laboratory, Moffett Field, Calif. In the foreground is a large tank containing air under high pressure. Next is a special trumpet-shaped nozzle, contoured so that air flowing through it gradually changes in density in the same way that the earth's atmosphere changes in density with altitude. Further back is a pipe leading to a vacuum sphere. Not visible in this photograph is a high speed gun used to launch a test model upstream through the special nozzle while air is flowing through it. Operators are adjusting the spark shadowgraph station required to make accurate picture and time records of the model in flight. When a gun-launched model flies at full re-entry velocity into the simulator nozzle, it experiences during a few thousandths of a second the decelerations, stresses, pressures and temperatures of actual entry. The simulator can quickly and economically determine in the laboratory whether a design can survive atmosphere entry.

Bits And Pieces

An all-weather landing system—a commercial version of an earlier system developed for the Navy and Air Force by Bell Aircraft—has successfully guided a Boeing 707 jet transport to a landing in tests at Seattle. In the radio-radar system, radar tracks the plane and an electronic computer programmed for a desirable flight path radio's corrections to the plane's automatic pilot.

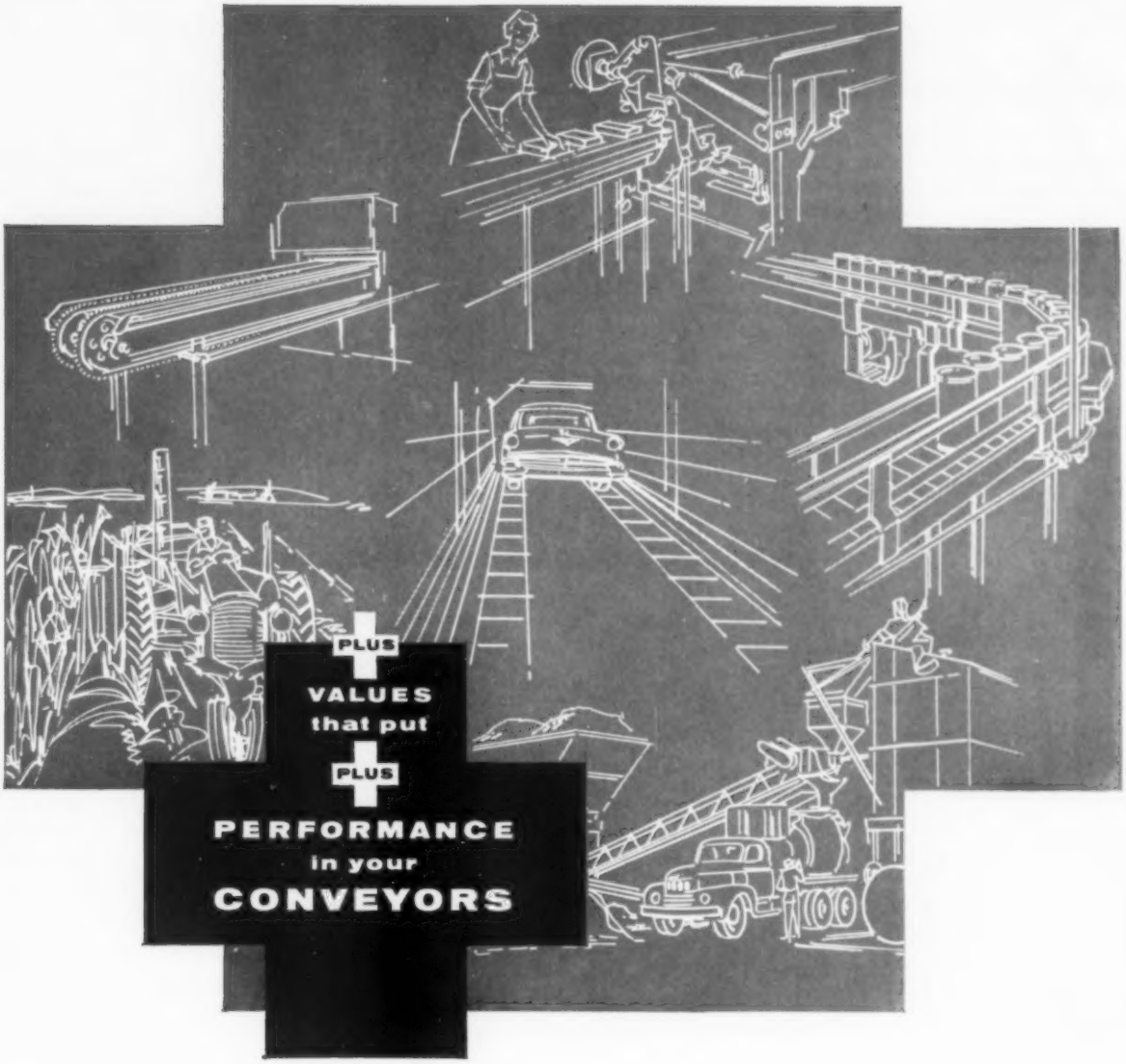
An Astrionics lab at Fort Wayne, Ind. for developing guidance and control, data processing, and instrument systems that will be required in space missions has been established by International Telephone and Telegraph. Additionally, a $1 million lab to study extreme temperatures, shock, vibration, atmosphere dust and humidity conditions encountered in missile flight is being built by Canadair Ltd, General Dynamic's Canadian subsidiary. Canadair produces the Sparrow II air-to-air missle.

Modified Formica FF-34 laminated plastic is withstanding temperatures up to 2500 F for eight minutes as a thermal barrier between the solid propellant and motor case of the XKDT-target drone, according to Temco Aircraft sources who are developing the rocket for the US Navy.

Soviet Prime Minister Khrushchev, in a recent speech in Bitterfield (East Germany) said that Russia will employ "with pleasure" German engineers and scientists regardless of their political attitude, and pay them better than the richest companies in the US or West Germany. . . . A test bench that will check the performance of a wide variety of automotive transmissions has gone into production at Consolidated Diesel Electric Corp., Stamford, Conn.

Engineer Grad Pay Up

CORVALLIS, ORE.—Average starting pay for Oregon State College engineering graduates has increased from $4380 to $5640 in the last five years, M. H. Haith, engineering placement officer, reported. Engineering graduates of last June averaged $470 a month, up $25 a month from 1957.



What do we mean by *plus values*? They're the built-in extra strength...extra dependability...extra long life demanded in conveyor service. Conveyors just can't afford failures that can cause a complete plant shutdown...lost production time that can't be recovered.

To be sure of that protection against costly failures...to assure the dependable performance you want...specify CHAIN Belt conveyor and power drive chains, sprockets, roller bearings, flexible couplings, apron feeders and belt conveyor idlers. These are *plus value* products...designed and built to assure plus performance under any operating condition. And you get another *plus*...the application selection help of your field-trained CHAIN Belt District Sales Engineer. From his complete line of *plus value* products, he can help you select the exact component that will assure plus performance in your conveyors...from light-duty packaging to heavy-duty automotive assembly conveyors. The following pages tell why it pays to protect your good name with another...CHAIN Belt!

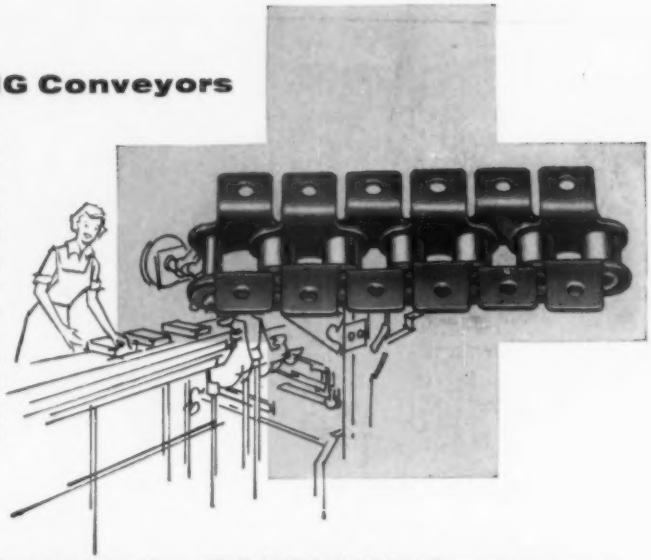
CHAIN BELT

4715 W. Greenfield Ave., Milwaukee 1, Wis.

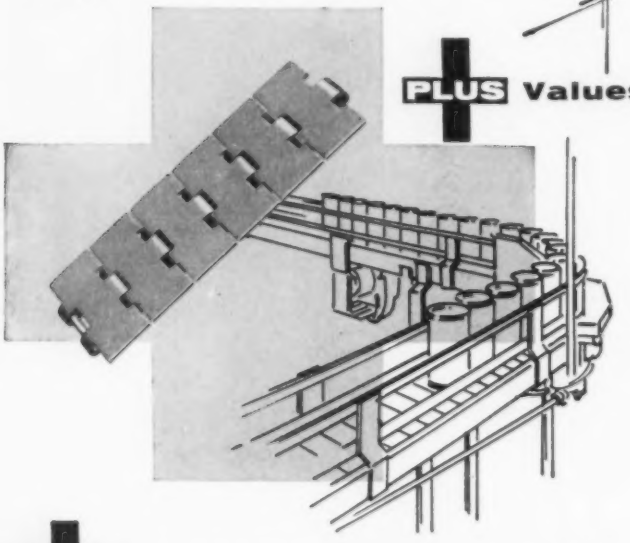
TURN PAGE

PLUS Values for PACKAGING Conveyors

In packaging conveyors, where high speed and accurate timing of operations are required, Rex Roller Chains provide *plus values* in longer service life...more efficient operation. Precise manufacturing techniques assure exceptional pitch control...an important advantage that assures exactly matched chain strands required in many conveyors. You get smoother operation...close control of packaging operations. Extra wear life and fatigue resistance are built into these quality chains with such important features as positioned seam bushings...designed-in beneficial stresses in link plate holes...round, matching rollers and bushings.



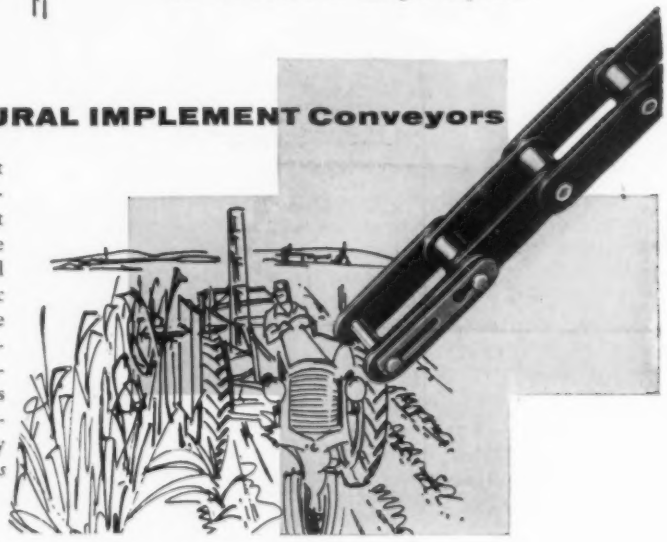
PLUS Values for CONTAINER Conveyors



For most efficient handling of bottles, cans, jars, cartons and small parts, your *plus value* choice is Rex TableTop Chains. Long the accepted standard in the food and beverage industry, these smooth-operating chains provide a level, virtually tip-free carrying surface. TableTop Chains are simplicity itself...just a platform link and pin. They stay cleaner...are easier to clean. No pockets to catch and hold foreign matter. No attachments to wobble or work loose. And TableTop is also available in Nylon. This is your choice where lubrication cannot be permitted...where lighter weight combined with smoothest handling is required.

PLUS Values for AGRICULTURAL IMPLEMENT Conveyors

To provide the efficient operation at economical cost required in agricultural implements, you need the *plus values* of Rex Implement Chains. These double pitch roller chains provide the smooth operation and strength of standard ASA roller chains but at lower cost. Five basic chains in this series offer the designer a wide range of selections to fit the individual implement requirement, and a complete range of steel detachable chains is also available. Whether the choice is based on greatest initial economy or longest overall life, there is a Rex Implement Chain to exactly fit your need. And all offer CHAIN Belt *plus values* in their service range.



CHAIN BELT

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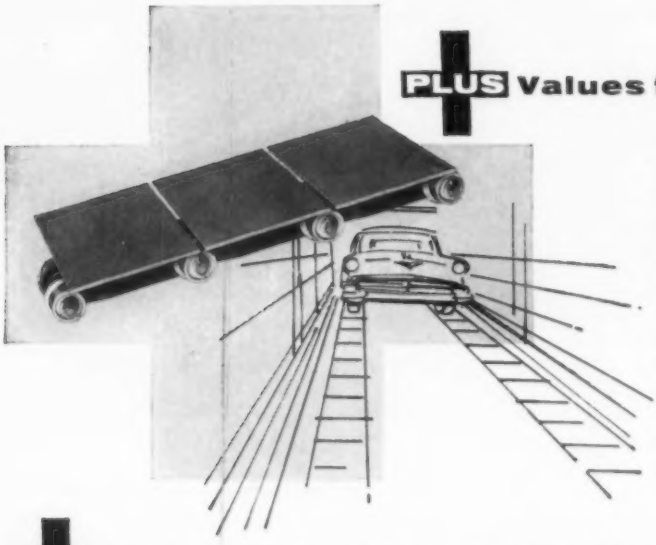
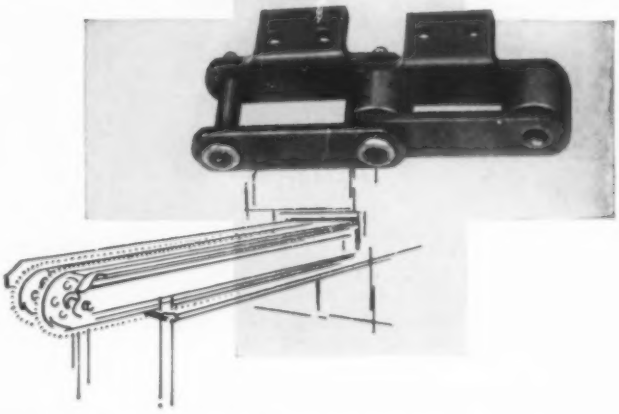


PLUS Values for ASSEMBLY Conveyors

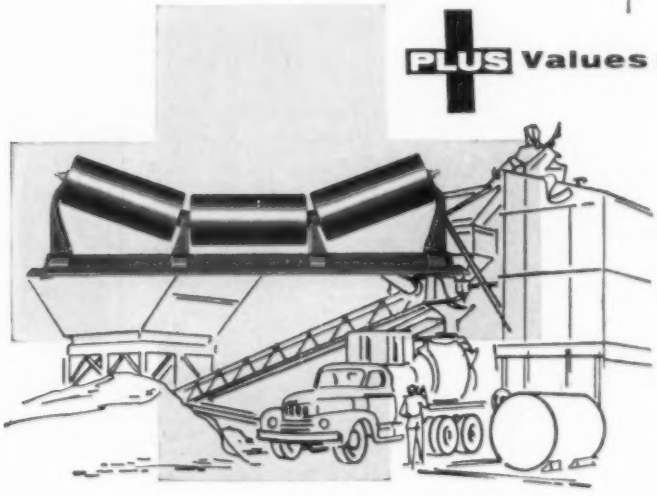
Automotive plants must operate on split-second assembly line production schedules. Failure of plant equipment cannot be tolerated even for seconds. Assembly line conveyors must be kept moving; Rex Automotive Line Conveyor Chains and Sprockets supply the *plus values* for smooth, dependable service. *Plus values* such as carefully held tolerances of all parts *plus* proper heat treatment, plus outboard rollers to reduce friction, all assure maximum smooth operating life and provide maximum wear life. Most assembly line conveyor chains originally used were Rex, many still in service after 25 years...today's *plus values* reflect many years experience of supplying the automotive industry.

PLUS Values for OVEN and FURNACE Conveyors

Many years experience is necessary to build the *plus values* required of chains for oven and furnace conveyor service. The wide range of loads imposed on these chains operating at higher than normal temperatures requires design engineering and manufacturing techniques acquired only through years of experience. *Plus values* of Rex Oven and Furnace Chains are all parts precision made to the proper tolerances for high-temperature service...correct materials...accurate heat-treatment techniques...experienced engineering and design for each individual application... rigid testing and inspection.



PLUS Values in BELT Conveyors



Rex Belt Conveyor Idlers are "rated" for service... assure you, in advance, of the life expectancy you want. Idlers are selected quickly and easily from simple selection charts. No need to buy more life than you need...no need to take less than you want. A complete line enables you to satisfy any requirement: troughing, return flat belt, self-aligning, impact cushioning, spiral return and special types...ball or roller bearing.

These are but a few of the many types of CHAIN Belt conveyor components that put *plus* performance into your heavy-duty conveyors. For complete information and selection assistance, write CHAIN Belt Company, 4715 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT

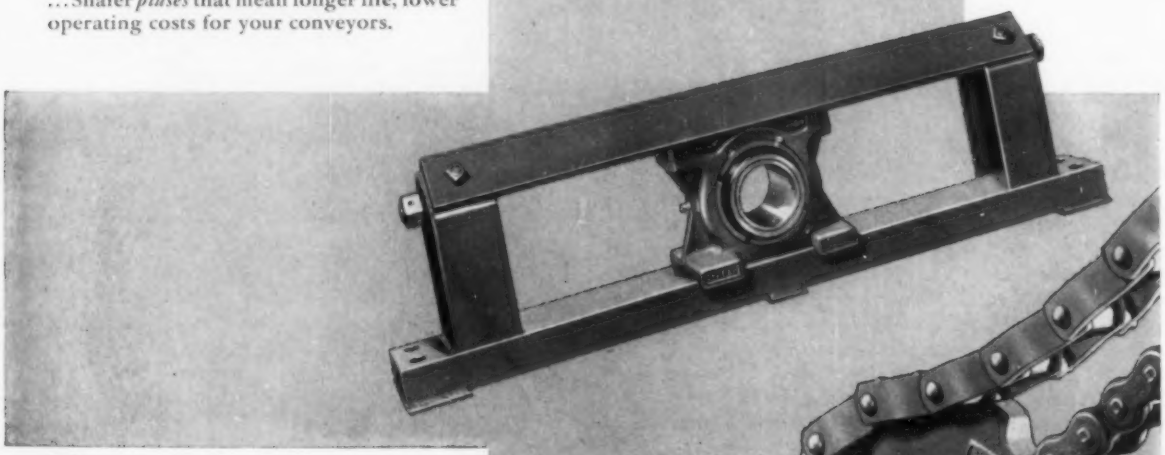
4715 W. Greenfield Ave., Milwaukee 1, Wis.

TURN PAGE

PLUS Values for any Conveyor

To put *plus* performance in any conveyor, take advantage of the *plus values* offered by Shafer Self-Aligning Roller Bearings...in pillow blocks, take-ups or cartridge units.

With Shafer you get *plus* capacity. They'll deliver their rated load capacity for five years and more. Compare this with other bearings that will carry the same load for less than a year. And the high degree of internal self-alignment provided by Shafer compensates for shaft deflection, shock loads and misalignment so common to heavy-duty conveyors. With these bearings you get the low rolling friction of a ball, the high load-carrying capacity of a roller ...Shafer *pluses* that mean longer life, lower operating costs for your conveyors.



PLUS Values for any Drive

Rex Roller Chains add an important *plus* to your conveyor drives. They have the high fatigue strength and long wear life demanded in this service. Accurate pitch control, beneficial stresses in link plate holes, positioned seam bushings assure maximum fatigue resistance. Rex Chabelco Steel Chains are your *plus value* choice for heavy load, moderate speed drives.

For complete information on Shafer Bearings, write for Bulletin No. 55; for data on Rex Roller Chains, send for Bulletin No. 5725. CHAIN Belt Co., 4715 W. Greenfield Ave., Milwaukee 1, Wis.

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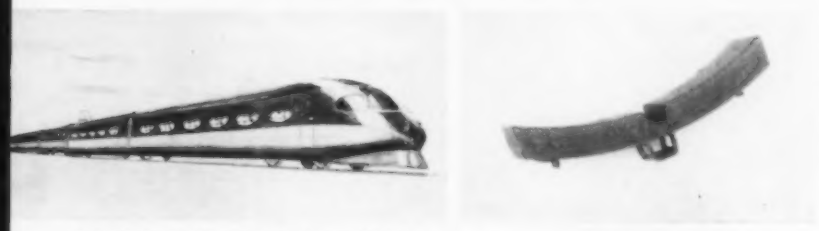
CHAIN BELT



Scheduled departure time: 1964 . . .
Japan National Railway Corp., in Tokyo will soon start building this ac electric train (left). Consisting of some 15 cars, each 75 ft long and 10 ft wide, and equipped with a 15 kw motor, the "Super Dream Express" is expected to make the 311-mile run from Tokyo to Osaka in less than 3 hours. The aluminum-bodied, steel-frame cars accommodating 48 passengers will weigh between 3 and 4 tons and will be equipped with rubber-covered wheels. Tunnel exits and entrances en route will be tapered to reduce air resistance. A lightweight plastic train brake, right, approved by Japan Railway Corp.'s laboratory for production is molded from a phenol resin, with asbestos, metal powder fillers. Coefficient of friction is 30% less than iron, weigh less than ⅓ iron brakes.

USSR Car Industry Lists New Models

Moscow—The Soviet auto industry, seeking cars of higher durability and reliability in operation, is producing the following models:

GAZ-69 truck has been remodeled and now comes with a two-wheel or four-wheel drive and can carry a load of 1650 to 1760 lb.

Medium and high-capacity trucks have undergone changes. The ZIL-150 has been replaced by the ZIL-164, a four-tonner with improved traction-dynamic performance and higher maximum and average technical speeds. This has been achieved by increasing the capacity of its six-cylinder engine to 100 hp, and improving a number of its transmission and drive parts.

At the same time production is being launched on a **six-wheel cross-country truck,** ZIL-157. Its engine has a maximum capacity of 108 hp and a speed of 40.3 mph.

Of the **new high-capacity trucks** the 3-axle, 6-wheel drive, 7-ton YAZ-214 and 3-axle, 4-wheel-drive, 12-ton YAZ-219 have a 180 hp, two-stroke, diesel engine.

Of the **dump trucks,** the newest model is the 40-ton, 3-axle MAZ-530. Equipped with a V-12, 450 hp engine, it is designed for heavy-duty service at strip mines and quarries. The Yaroslavl Plant has launched production of a 12-ton dump truck, the YAZ-222, and the Kutaisi plant, a 3.5-ton KAZ-600. Both have a two-side discharge. These factories have produced dump trucks that can be unloaded on three sides.

Chaika passenger car, GAZ-13, with a powerful engine and automatic drive will replace the ZIM.

In the lower cost, small economy car field the Soviets are developing a **midget 4-seater sedan,** with a 20 to 22 hp engine, having maximum speed of 53 to 60 mph, getting about 41 miles per gallon.

The motor industry has also developed the high-speed, 32-seat, long-distance bus, the ZIL-127 (*PE, July 28, '58, p. 3*). It is equipped with a powerful engine and can develop a speed of up to 62 mph.

New buses have also been developed for the municipal transport service: the 23-seat PAZ-652 and 32-to-36 seat ZIL-158 and LAZ-695. They are all provided with good ventilation and equipped with heaters for winter use.

IAEA Speeds Flow of Technical Information

VIENNA—The International Atomic Energy Agency has entered into two agreements for collaboration in the field of scientific and technical information. Under the first agreement, the IAEA and the United Nations Educational, Scientific and Cultural Organization (UNESCO) will contribute financially, on a 50-50 basis, to the publication in eight languages of an "International Electrotechnical Vocabulary" by the International Electrotechnical Commission, Geneva.

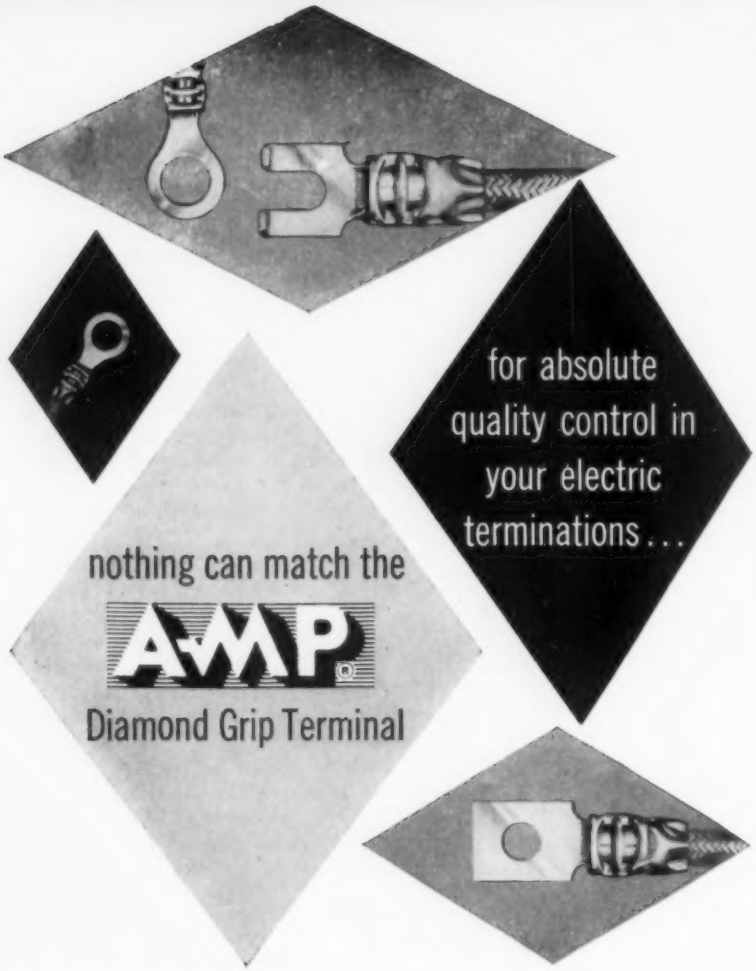
The IEC, affiliated with the International Organization for Standardization, is producing a revised edition of its international electrotechnical vocabulary and the part relating to atomic energy will be drawn up with the help of the IAEA and UNESCO. Experts will first define the exact meaning of the terms in English and French and these definitions will in turn serve as a basis for establishing equivalent terms in other languages.

The second agreement ties the Library of the Institute of Physics of library of the IAEA and the Central Vienna University.

The library in Vienna has been in operation for many years, maintains a large collection of scientific periodicals and books dealing with the general field of the peaceful uses of atomic energy and related sciences. This material will be made available to members of the Agency's staff and to persons authorized by the IAEA Director-General.

Additionally there will be an interchange and loaning of publications between the two libraries. To enable the Central Library of the Institutes of Physics to provide the necessary facilities to the IAEA, the Agency has agreed to make regular financial contributions to the library.

When a test sled broke up . . .
while running on the track at about 1800 mph—300 mph over the design limit—at the Project SMART Hurricane Mesa track at Hurricane, Utah. Coleman Engineering Co. Inc., prime contractor, says the actual loads imposed on the rail are not known, but the ram air pressure acting on the vehicle was about 7,500 lb per sq ft, which gives some indication of air resistance. In normal operation sled is decelerated by a water scoop in the trough between the rails. Track is 12,000 ft long; rails are 105 lb/yd as used for cranes.



An endless parade of electrically perfect, wired terminals with absolutely identical performance characteristics is assured when A-MP non-insulated Diamond Grip terminals are used. No matter how many terminals you need, each action of the A-MP precision tool attaches a Diamond Grip terminal that gives firm, fully circumferential wire support, for maximum tensile strength, resists vibration and corrosion, while performing at maximum conductivity.

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Develop High Accuracy Electronic Commutator

PRINCETON, N. J.—An electronic commutator with high accuracy over a wide range of mixed source impedances has been developed by Applied Science Corp., of Princeton (ASCOP).

The new solid state multichannel sampling switch has an input-to-output accuracy of 1% or better for any mixed source impedances up to 25K ohms. This accuracy figure includes linearity and offset factors.

In addition, the commutator develops a back current of less than 1 micro-ampere during the time a channel is "off." This negligible back current eliminates the problem of transducer "loading."

Both the accuracy and non-loading features have been engineered as inherent parts of the ring counter, actuated diode, gating circuitry which forms the heart of the ASCOP commutator. It is designed for long-life applications in data handling systems using time-division multiplexing. The commutator will handle 0 to 5V input signals in all I.R.I.G. standard Pulse Amplitude (PAM) and Pulse Duration (PDM) sampling rates. Standard channel configurations are 30 and 45, including synchronization pulses.

The commutator retains all the conventional advantages of solid state switching. Power consumption is less than 3 watts. Design life expectancy is 5,000 hrs, without maintenance. Operating temperature range is −60°C to +80°C with special packaging available for extreme intermittent temperatures. The commutator's size is approximately 45 cu in., weight is approximately 32 oz.

Key Executive Seeks More R&D Flexibility

SAN FRANCISCO—The nation's defense research and planning is saddled with elaborate prevention-of-mistakes machinery—the biggest mistake of all.

This was the comment of C. W. LaPierre, executive vice president of General Electric, made recently to 50 high school mathematics teachers. LaPierre, the group executive responsible for the operation of G-E's electronic, atomic and defense operations,

is in charge of about 25% of the company's $4 billion plus annual business.

These inevitable mistakes that must occur during research and development are frozen in long past the date when they can be corrected economically. This, he said, greatly delays or prevents progress and enormously amplifies cost, and it becomes the greatest mistake of all.

"And when a program bogs down, the public outcry is for another Russian invention, a 'czar' to cut through the red tape and accomplish what the armed forces and industry have been trying to do all along." This is not to say there should be no controls, or secrecy; but, like incentives, they should not exceed what is necessary to attain the objectives.

LaPierre criticized continuity of military research and development. Budgets are turned on and off. Programs are cancelled with the shifting of defense needs, and there is emphasis on short term rather than long range weapons development.

"Today's military research and development contracts leave only one chief economic incentive to industry—the highly speculative hope the industry will get a production contract, when the greatest need may be for more basic research and exploratory development," he said.

"In developing a new civilian product, there is no substitute for men with a demonstrated capacity for making the right decisions and, equally important, for detecting and correcting the inevitable mistakes before they get frozen into the design.

"By contrast, in military products the producer is beset by a considerable number of people with the laudatory—yet impractical—objective of preventing all mistakes. These people have tremendous veto powers. But the people with the go-ahead authority are rarely in evidence and sometimes can't be found at all for long periods. The flexibility to 'turn on a dime' is lost by this procedure, and many initial mistakes get built in to be changed later at much greater expense."

He said that although the military services go through the motions of placing responsibility on their contractors for weapons design and development, they frequently specify how this work shall be done and retain authority to approve design drawings, engineering changes and proposed deviations from the specifications.

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Either coating provides corrosion resistance superior even to complicated electrolytic treatments in a fraction of the time. These coatings also offer many other valuable characteristics: they have low electrical resistance, they aid in arc-welding, provide a good base for bonding compounds, have no effect on the dimensional stability of close-tolerance parts. Final appearances ranging from clear through yellow iridescence to full brown can be obtained. By dyeing, you can produce red, green, blue, orange or yellow finishes.

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Solar Heat Experiment May Lapse—No Money

PHOENIX, ARIZ.—The future of a solar-heating experiment here is in doubt. According to the Association for Applied Solar Energy, sponsor of the house, because of zoning restrictions and a lack of funds.

The house *(PE—Mar. 10, '58, p. 26)* was completed last April under the direction of John Yellott, consulting engineer and executive vice president of the Association. Cost of construction was put at $70,000, plus $13,000 for extensive instrumentation. Funds for maintenance of the house were to be obtained by charging 85¢ per visitor.

However, the house was located in a residential district, and neighbors complained to the city zoning board, citing traffic congestion caused by visitors. Recently, the zoning board ordered the association to discontinue its "commercial enterprise." Without this revenue, the Association had to let Yellott go, leaving the solar-heated house, and the Association, without an engineer on its staff.

FORCED TO SELL

The directors have put the house up for sale—at $50,000—with the condition that they retain access to the house to record performance and maintain the instrumentation. If the property is sold, the Association hopes to rehire Gary Herberger, the engineer who supervised installation of the instrumentation.

Solar radiation in the house is collected by movable louvers overlaying a central court and two patios on the north and south ends of the house. The louvers are adjusted daily to the best angle for collecting sun's energy in cool weather or reflecting it in summer. Louvers will heat the house and swimming pool in winter, provide hot-water requirements year-round and minimize cooling load in summer. A heat pump will supply additional heat when necessary during protracted cold spells.

Concrete floors of the house are supported on a network of metal domes over a sub-floor. Air circulating through the domes warms the floors in winter and cools them in summer. After heating or cooling the floor, the air enters rooms through grills in the north and south faces of the house.

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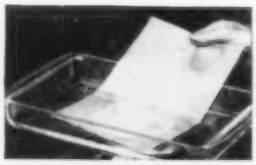

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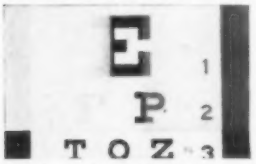

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PRE-DEVELOPMENT PLANNING:

four steps to low-risk products

ZUCE KOGAN, *Consulting Engineer*

■ Your company must find new products or go out of business.

Copying or restyling is not enough.

In 1960, 13% of all civilian-goods purchases will be of products not yet developed last year. RCA alone expects to double its sales in ten years with products currently non-existent. The injunction is plain:
Modernize your pre-development planning—or succumb to competition.

Most companies treat new-product finding as a haphazard appendage to product development —and the mortality rate shows it.
Pre-development planning should precede product acceptance. It must involve a careful match of the new product to company capabilities and know-how. Good planning will narrow the choice to those few ideas that make better-than-average product risks. . .

HERE'S HOW ⇨

1 COMPANY LIMITATIONS

First, what can (and can't) your company do? If present production is seasonal and you want to fill in the valleys to make existing plant and equipment pay off, you are limited to the products which can be turned out on that equipment.

What about your sales and distribution setup? Unsuitable marketing facilities can quickly torpedo a new product. Will the new product justify a risk in unfamiliar selling and advertising?

The company's financial situation heavily influences product planning: a firm with a few million dollars of idle capital may not be concerned about additional equipment or an increase in sales staff. It is willing to gamble for big stakes and a high sales potential. A smaller company may prefer less potential with less risk.

With preliminary objectives roughed out and company limitations accepted . .

2 FIND THE BEST PRODUCT

Profitable existing products or lines are good guides to highly profitable new products. Note that a company must not be satisfied with the mere existence of a profit; it must seek the greatest possible profit from each product.

Seasonability may strongly influence the choice. A manufacturer of Christmas gifts might look for a portion of the June wedding or graduation day market to fill out its seasonal lull.

Materials can also influence product selection. A manufacturer of copper parts found plastics taking some of his sales. A market study convinced him that his market was doomed. Rather than scrap his metal-working machinery he found a new product in which plastics couldn't touch him.

With product categories established, let the imagination loose on the problem. The product must be new or have significant innovations. It must have customer appeal. Here originality and creativity are essential.

When a bright idea does turn up, make a report and preliminary drawing emphasizing what is new, what makes it superior to the competition. Run a patent search for absolute safety. Then . . .

3 SCREEN AND EVALUATE

Methodical, unemotional screening will eliminate products which are impractical or do not fit company limitations. Methods vary, but thorough screening should consider about 50 items. Effective evaluation would include a method for grading each screened item. In this system, for example, a product would be graded zero under "Service Facilities" if it requires servicing—and no facilities were available.

Regardless of individual procedures, screening must be designed to fit the newness of the product and will include several points. "Timeliness" is one. Often products are so far ahead of their time that vast advertising expenditures are necessary to create a demand for them. If company finances can't stand that drain, it's best to look for another product. A good screening should also include the non-competitive life of a new product. Every new product has a life span which depends on how soon a competitor enters the market.

Before a single development dollar is spent, planners must estimate development costs and submit design recommendations based on studies of . . . . . .

4 THE NEW PRODUCT MARKET

The market study should:

- assure that the product has adequate sales potential.
- seek factors which could *increase* this potential.
- provide information to development engineers

For example, customer response on one study led a manufacturer to increase sales by miniaturizing his siren adaptors so they'd fit in restricted spaces. And market research told another firm that "install-it-yourself" kits would eliminate many customers' objections to high installation costs.

Market research should also give some indication of possible price categories. Industrial customers with large engineering staffs seem to prefer expensive apparatus bristling with knobs, gages, dials and other controls, while smaller companies want the simplest, least costly units. Best practice is probably to set up *two* designs to reach customers in two price categories. That way, demands of both large and small companies are satisfied.

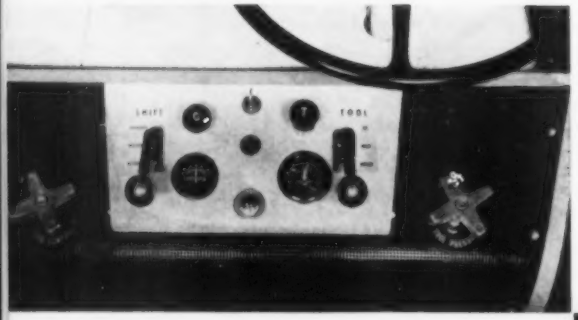
Finally, the market research program should determine the extent of indirect competition. For example, how would a pipe coupling compete with a pipe union?—Although different, both products do exactly the same job.

THEN DEVELOP

When the market study is finished, the manufacturer is ready to decide on the over-all feasibility of a new idea and, if the verdict is favorable, turn it over for development. Because of his market sutdy, he's able to recommend possible improvements to the designer. And the designer will probably come up with some more. But one caution here: if suggested improvements are radical and costly, they too should go through a planning cycle to guarantee their feasibility. Then, when the new product hits the market, the manufacturer's careful planning will pay off in higher success percentages and wider profit margins. ■

TRENDS in

POWER VACUUM SWEEPER, re-designed model at right, old model below.

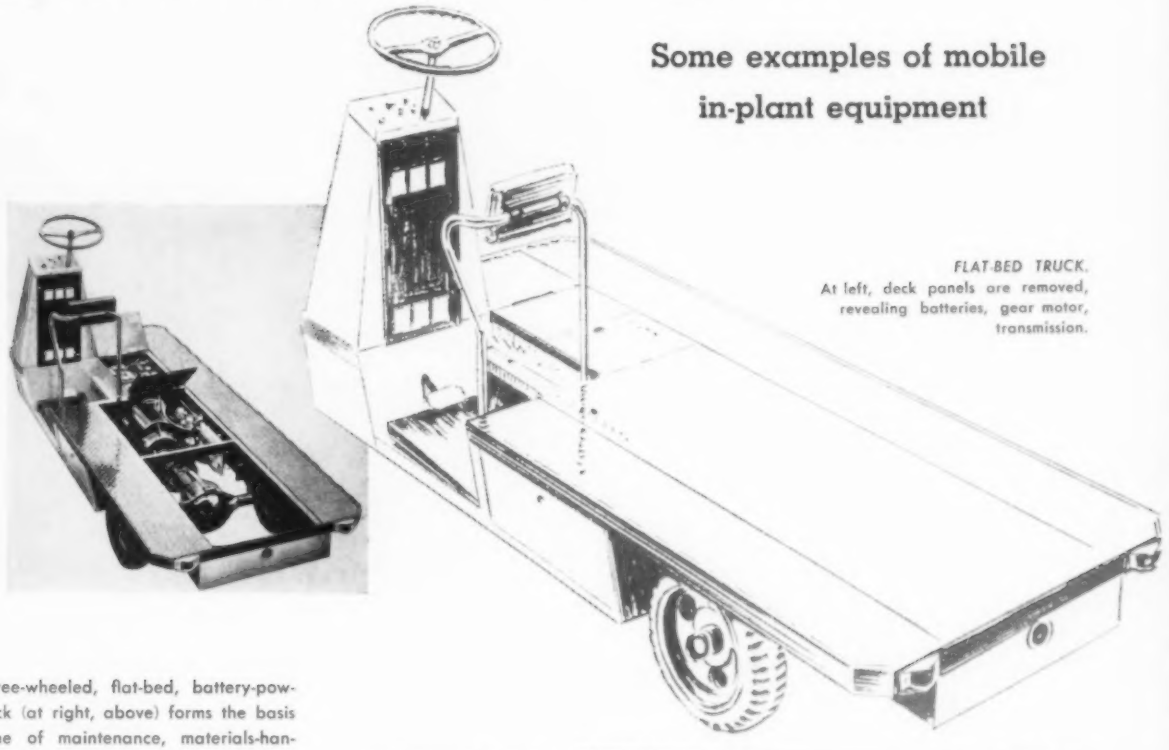


INSTRUMENTS AND CONTROLS (left) are grouped for operating in standing position in floor-cleaning machine (below).

SHORT-WHEEL BASE power sweeper.

appearance design...

Some examples of mobile in-plant equipment

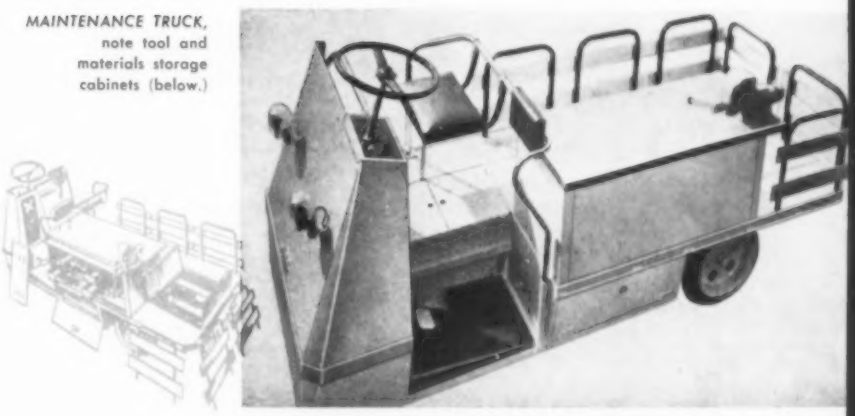


FLAT-BED TRUCK. At left, deck panels are removed, revealing batteries, gear motor, transmission.

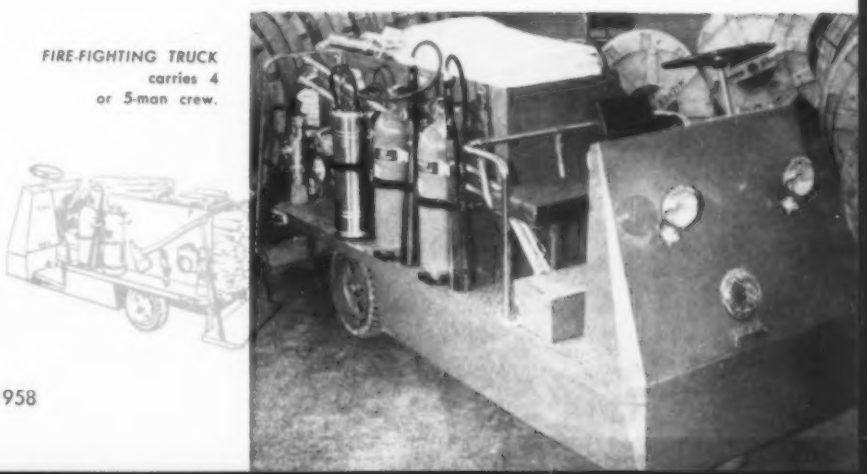
■ A three-wheeled, flat-bed, battery-powered truck (at right, above) forms the basis of a line of maintenance, materials-handling, personnel-carrying and fire-fighting units. Standard gear motor and 9 ft x 40 in. wide chassis can carry up to 1 ton, plus four or five men, at speeds as high as 14 mph. Driver stands on treadle-type platform that functions as a "dead-man" brake and motor control (on fire truck his weight also switches on siren and light). 90° turns can be made in aisle intersections as narrow as 7 ft. Built-in charger plugs into any 115-v outlet. Made by Victor Adding Machine Co., Chicago 18.

An industrial power sweeper (opposite page) is the latest in a series of mobile housekeeping equipment redesigned by Scharfenberg-Polivka of Glen Lake, Minn. for G. H. Tennant Co. Transmission, drive assembly, steering systems, vacuum equipment and engine are the same as in old model. Wrap-around bumper forms top of chassis, and sheet-metal housing encloses more compactly arranged structural and operating elements. Except for hydraulic mechanism added to lift dirt-collecting bin from beneath driver's seat, new model is no more costly to build than its predecessor, although brush is now engine-driven. Previously re-designed industrial housekeeping equipment in this line are also shown ■

MAINTENANCE TRUCK, note tool and materials storage cabinets (below.)



FIRE-FIGHTING TRUCK carries 4 or 5-man crew.



unusual design in upset forging...

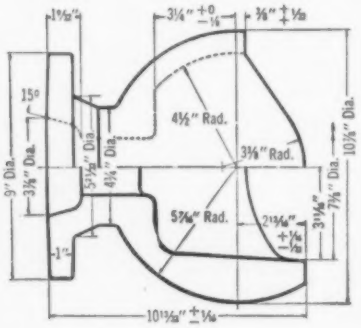
BALL-JOINT HOUSING for the steering and driving mechanism of the Clark Equipment Company's line of Four-Wheel Drive MICHIGAN End Loaders and Turbo-Dozers formerly produced as a steel casting is now turned out by Commercial as a closed-die forging on an 8-inch upsetter.

80 lb. forging replaces 95 lb. casting

A saving of 15 lbs. of metal on each housing component is only part of the impressive cost cutting story made possible at Clark Equipment Company by a switch to upset forgings.

When the parts were produced by Commercial as closed-die forgings on an 8-inch upsetter Clark Equipment reported:

1. An initial cost saving of 90¢ per part.
2. Closer tolerances for a 10% machining cost saving.
3. No rejects due to hidden metal defects.



UNUSUAL SHAPE and characteristics notwithstanding — flanged on one end, belled on the other, and open on both ends—Commercial engineers proved this part could be produced as an upset forging with greater cost savings.

Now, this important component not only costs Clark less per unit, but because of its controlled grain flow and efficient metal distribution it provides maximum tensile and torsional strength to resist unusual operating strains as well as massive and unpredictable shock and load. Longer operating life and trouble-free performance are assured.

And because forging impact and pressure produces a more dense, more uniform metal structure, forged parts absorb and dissipate heat at a uniform measurable degree. Obviously, that means elimination of distortion problems in heat treating. It also means fewer rejects during machining, since this dense uniform forged metal has no hidden internal flaws.

With new forging techniques continually unfolding to meet specific job requirements, more original equipment manufacturers are increasingly looking to upset forging to help solve their component forming problems — stronger, lighter, more compact parts at less cost per unit.

Many parts like this unusually shaped housing for Clark Equipment, which were formerly considered impossible to forge, are now routine at Commercial. An early check with Commercial's forging engineers on your particular component forming problem may pave the way for improvement in your product design and production methods—could save you time, money, and help improve performance and operating life.

WHEN AN UPSET FORGING?

Check your part forming problems against this list of "bench marks" for parts requiring:

- Reduced weight, thinner section, greater strength.
- Consistent soundness — no losses due to porosity.
- Good appearance—smooth, close-grained surface.
- Superlative shock and fatigue resistance.
- Uniform response to heat treatment.
- Cost-cutting advantages in finishing—less waste metal, reduced machining, no rejects due to hidden flaws.

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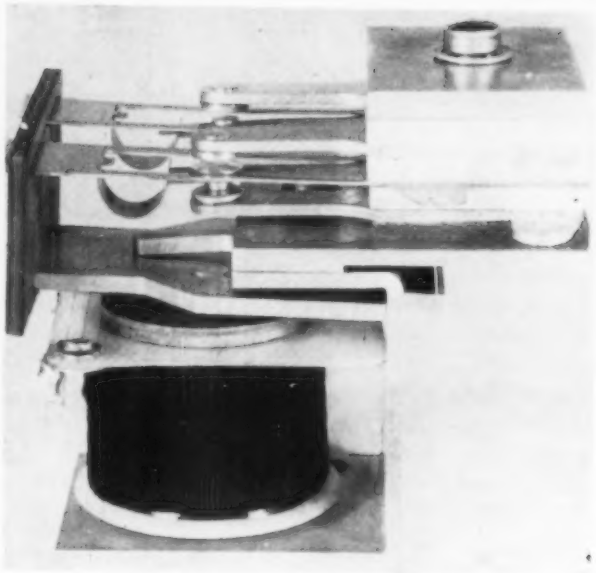
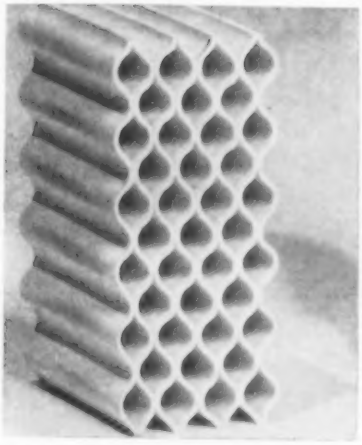


Snap-action power relay with rolling springs . . . has ½-hp. 15-amp rating, 115 v ac. Silicon-steel core reduces residual magnetism. Coil temperature stabilizes at 146 F on 115 v. Single-screw mounted switch stack permits side location of terminals. A smaller, general-purpose relay with a 10-amp rating is also available, based on same silicon steel core design, but without rolling springs. Measures 2.1 in. long. About $2, in large quantities, for 2PDT; 5 to 8-wk delivery now; later from stock. **Arco Div., Robertshaw-Fulton Controls Co., Columbus, Ohio.**

Circle 11, inside back cover



Ceramics that are ductile . . . during rolling, forming, corrugating are then fired into finished shapes. Can be made into extremely thin, high-surface area structures, permitting fabrication of lightweight ceramic heat exchangers and structural units, which previously could be made only of metals. Above is zirconium oxide; also available, bonded silicon carbide, magnesium aluminum silicate. Samples, to specifications, can be furnished. **American Lava Corp., sub. Minnesota Mining & Mfg. Co., Chattanooga, Tenn.**

Circle 12, Reader Service Card

Vane-operated limit switch . . . requires no separate power supply. Operating life is expected to be three times that of lever switches when used with conventional low-coil current relays. Said to be capable of over 250 million operations with static control. Magnetic device is energized by passage of a separate metal vane through a recessed slot in switch. Attached to the mechanism to be controlled, vane disturbs magnetic field balance that causes two small contacts to operate. Normal stray magnetic fields and presence of magnetic dust and chips in slot will not cause false operation. Operation is said to be consistent within ±0.0025 in. providing position of vane is maintained. Response time is approximately 0.001 sec. Rated 115 v ac and 0.2 amp make or break; available in normally open and normally closed forms with or without neon indicating light. SPST design meets JIC requirements. Operates at any angle. Said to be half the price of most proximity switches. **General Electric Co., Schenectady 5, N. Y.**

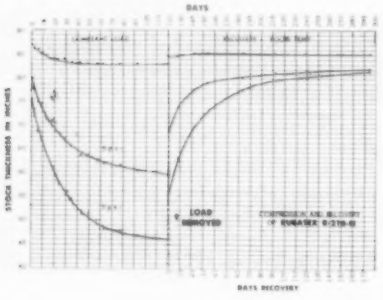
Circle 13, Reader Service Card

Rubatex gaskets insure tight seal on L & N instruments

Insures accuracy of L&N Speedomax H Recorder-Controllers as gasketing on instrument doors.

To see Leeds & Northrup instruments . . . on a foundry casting floor taking the guesswork out of pouring temperatures . . . controlling forging temperature and being subjected to severe vibration from 30 steam hammers 24 hours a day, 5 days a week . . . on countless other jobs with a wide variation in temperatures, atmosphere and usage . . . is to realize the important role of RUBATEX CLOSED CELLULAR RUBBER as an effective tight door seal to insure the accuracy of these instruments.

What's more – RUBATEX retains its shape and effective sealing qualities even though instrument doors may be opened daily for many years or sometimes left open to the atmosphere for weeks at a time.



Compression set tests run over a period of 42 weeks show how RUBATEX stocks recovered 92% to 97% of original thickness after dead load was removed—indicating the superior ability of RUBATEX to keep coming back for a longer time and to form a tight, permanent seal.

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RUBATEX DIVISION, Dept. PR-5
GREAT AMERICAN INDUSTRIES, INC.
Bedford, Virginia

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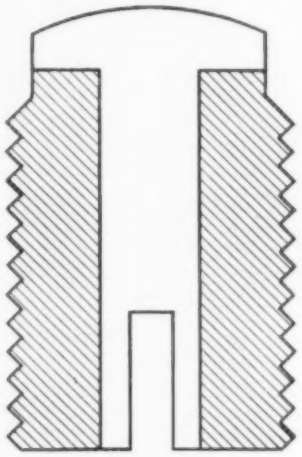
SIGNIFICANT COMPONENTS
MATERIALS
PROCESSES . . .



Electrical contacts . . .
are made from special rod stock with contact metal core that is upset to form contact face. This method can be used to produce any contact part that can be made on a screw machine. Core may be fine silver, coin silver, gold, palladium or any of a number of special alloys. Body material is usually free-machining yellow brass, although other materials can be used. Contacts are produced complete in one operation. There is no brazing or other operations employing heat. Tooling is said to be inexpensive. Contacts are reported to provide uniformity and accurate, improved electrical bond, high thermal and electrical conductivity, controlled contours. Made to specifications. Delivery within 30 days. Cost is said to be generally lower than conventional brazed contacts. **Fansteel Metallurgical Corp., North Chicago, Ill.**

Circle 14, Reader Service Card

Vertical rotary forging . . .
machine uses four die-faced hammers to shape a rotating round, square, solid or hollow billet, either hot or cold. Moving billet during forging is said to effect considerable material, time and weight (as much as 36%) savings. OD tolerances, ±0.012; ID, ±0.004 in. **Curtiss-Wright Corp., Wood-Ridge, N. J.**

Circle 15, Reader Service Card

Gear pump for up to 60,000 rpm, 4000 psi . . .
handles all ordinary oils, fluids, fuels. Cartridge-type construction provides hydraulically and thermally controlled gear clearance at all pressures. Cavitation is

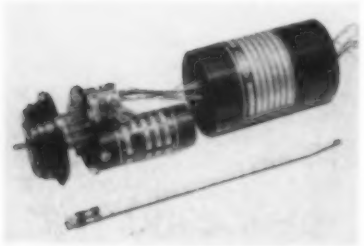
eliminated at high speeds by a bypass for leakage fluid permitting it to re-enter inlet chambers controlled by a spring-loaded valve that opens when pump tends to cavitate. Price and delivery information available only on specific customer requirements. **Adel Precision Products, div. General Metals Corp., 10777 Vanowen St., Burbank, Calif.**

Circle 16, Reader Service Card

Composite transistors and diodes . . .

combine a number of germanium and/or silicon junctions and associated protective circuitry into units that are said to provide ultra high gain, stability and other characteristics of the "ideal" transistor. At present these composites are available with following component properties: NPN, PNP, PNN, NPP power transistors and a shunt regulating diode. **Advanced Research Associates, Inc., 4130 Howard Ave., Kensington, Md.**

Circle 17, Reader Service Card



Miniature turret packages . . .

assemble precision rotating servo components in a manner unlike conventional packages, which line up components end-to-end. Because of mounting technique, motor can drive more than one component, each at the same or different gear ratios, and output shaft makes possible connection to other components or subassemblies. Photo shows a size 11 motor-tachometer, a gearhead and a potentiometer encased in a package less than 5 in. long, with a nominal OD of 2¼ in. **Mechatrol Div., Servomechanisms, Inc., 1200 Prospect Ave., Westbury, N. Y.**

Circle 18, Reader Service Card

Analog computer . . .

calculates and plots values of algebraic functions of a complex variable. Can be used in design of servomechanisms, synthesis of networks, analysis of electromechanical and electroacoustical devices or in other problems that require solution of Laplace transforms of linear differential equations. **Electro-Measurements, Inc., 7524 S. W. Macadam Ave., Portland 1, Ore.**

Circle 19, Reader Service Card

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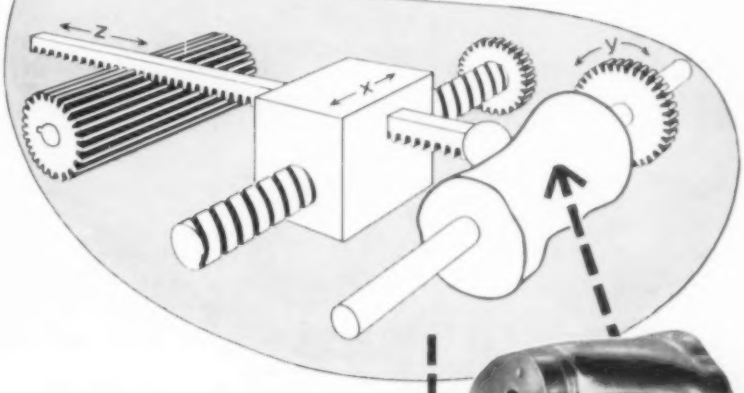

3 Dimensional Cams can be used in applications where "x" and "y" are input variables of

- temperature
- pressure
- R.P.M.
- liquid flow
- speed
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or any of thousands of other forces or motions.

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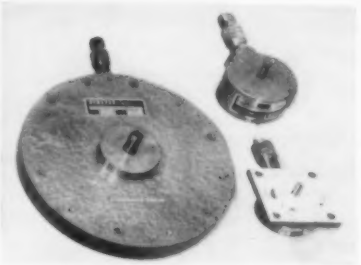

Rotary transducers . . .

are for counting and measuring applications where physical quantities can be converted into corresponding voltage pulses. When used with electronic preset counters, tachometers or frequency counters, they provide numercial readout of any quantity desired. Can also be used to actuate control functions on a range of equipment. Nominal speed range is 2 to 30,000 rpm and over 60,000 rpm for momentary use, with 1 to 1000 counts per rev. Units count directly, without gears. Torque ratings are as low as 1 in.-oz and below. For linear measurements, units are supplied with any dia counting wheel and any number of individual teeth, to represent most units of measurement. Other units include photo-transistor, explosionproof, tach pad and miniature types. **Dynapar Corp., Skokie, Ill.**

Circle 20, Reader Service Card

Stainless-clad copper wire . . .

is said to be suitable as an electrical conductor for equipment that must operate under high-temperatures, corrosive and oxidizing conditions. Produced by inserting an oxygen-free, high-conductivity copper rod into a chrome-iron alloy tube. Cold drawing and annealing results in a physical bond between cladding and core material. Wire is suitable for temperatures to 1300 F. Available in round wire sizes 0.005 to 0.250 in. dia and in tempers from soft annealed to full hard. Ribbon, rolled from round wire, is offered in widths to 0.125 in. Wire and ribbon can be furnished in a variety of spool and coil sizes. **Sylvania Electric Products, Inc., Warren, Penna.**

Circle 21, Reader Service Card

Explosionproof timers . . .

for use in Class I, groups C and D, and Class II, groups, E, F and G, atmospheres meets NEMA specifications. Includes single and multi-cam timers with 1 to 19 switches. Individual switch rating is 10 amp. Time cycles from ⅓ sec to 72 hr.

are offered. Time delay timers reset automatically and are available in time cycles from 1 sec to 3 hr. Load rating is 10 amp. Adjustment and dial are external. An automatic reset timer with a load rating of 15 amp has time cycles from 1 sec to 3 hr. A manual set timer with a load rating of 20 amp is available in time cycles from 15 min to 60 hr. Adjustment and dial are external on both timers. Running time meters and reset time totalizers are enclosed in glass-faced housings. Totalizer is reset to zero from the outside of housing. Both are available in counts from $\frac{1}{10}$ sec to a total of 100,000 hr. Screw joint housings are used. **Dept. A9, Industrial Timer Corp., 1407 McCarter Highway, Newark 4, N. J.**

Circle 22, Reader Service Card

Safe-load relay . . .

can stop an over-loaded electrical motor during critical peak or starting load period. Also provides protective functions relays give when more than normal running currents occur after starting. Applicable to most motorized units. Can also be employed in conjunction with various alarm systems. Action is controlled by a second pointer that can be reset very close to actual normal electrical power required by drive. To start motor after safety shutdown, pushbutton microswitch next to meter face is depressed, releasing pointer to close circuit for another normal start. **Baker Perkins, Inc., 100 Hess, Saginaw, Mich.**

Circle 23, Reader Service Card

Silicone insulated motors . . .

have flexible, replaceable coils, insulated with a silicone rubber vulcanized into a solid wall without joints or voids. Will safely operate completely submerged and can be used, without protective housings, wherever outdoor, hazardous or dust conditions prevail. Made in a wide range of ratings from 75 hp up (see PE, July 21, p. 89 for lower-rated motor). About 10% higher in price than standard Class A, insulated, open-type motors. Delivery 4 to 8 wk. **Allis-Chalmers Mfg. Co., Milwaukee 1.**

Circle 24, Reader Service Card

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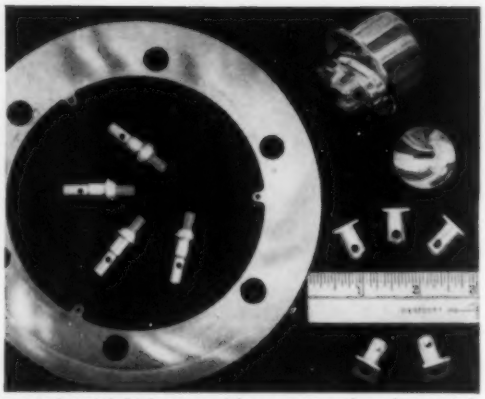

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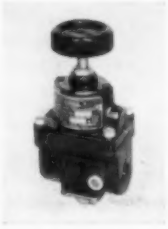

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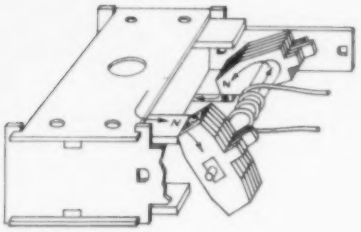
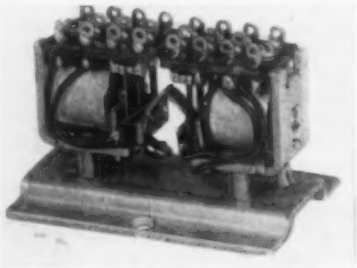


Toggle relay . . .

uses permanent magnet detenting to maintain contacts in either of two operating positions until momentary pulse of required polarity causes armature-coil assembly to rotate to second position. Relay is said to operate equally well on any voltage, current, frequency, ac or dc. Required pulse to operate is expressed in watt-seconds of energy: for a toggle relay having a 100 ohm coil requiring 20 v for 4 millisec to operate, pulse is rated as 16 milliwatt-sec. Same relay accomplishes contact transfer in 3 millisec on 110 v dc. Prices comparable to those of comparable conventional relays; samples (not free) available on a few days notice. **American Electronics Co., 2801 37 Ave., N. E., Minneapolis 18.**

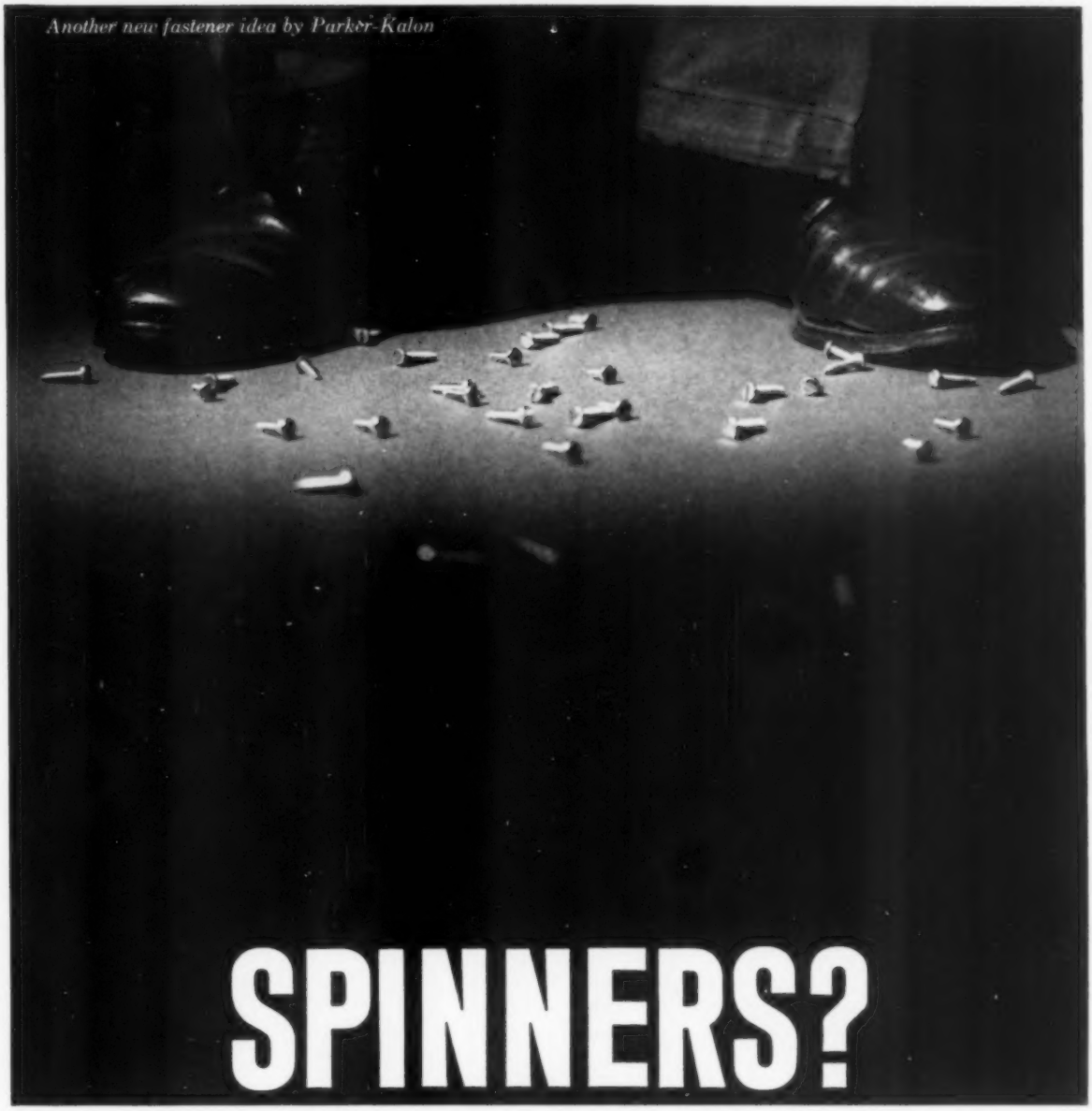
Circle 25, Reader Service Card



Miniature latching relay . . .

remains operative under 30 G shock and 10 G vibration at 55 cps. The 6PDT relay requires a 1.5 w pulse for 10 millisec to transfer contacts. Designed for intermittent duty. When contacts transfer, a mechanical latch locks them in position until second coil is pulsed to return them. This pulsing action reduces power consumed by relays and thereby permits use of smaller, lighter power supplies. Contacts are rated at 2 amp, 115 v, 60 cps for resistive loads. DC relay operates on voltages to 48 v. Can be furnished open or hermetically sealed. Open relay is $1\frac{7}{8}$ x $1\frac{7}{8}$ x $1\frac{3}{8}$ in. and weighs 4 oz; sealed unit is $2\frac{1}{16}$ x $1\frac{1}{4}$ x $1\frac{3}{32}$ in. and weighs 6 oz. **Potter & Brumfield, Inc., Princeton, Ind.**

Circle 26, Reader Service Card



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CIRCLE 80 READER SERVICE CARD

(Advertisement)

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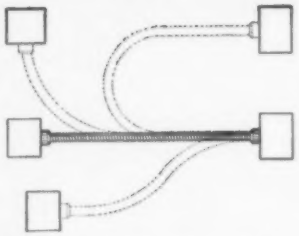

Before the innovation of Flexible Shafting, it was necessary to transmit power from a drive unit to its driven unit by means of a solid shaft which utilized expensive and cumbrous gearing. Today the Flexible Shaft alone provides a means of transferring this power from one unit to another by going around, over, and under obstacles. This allows you more space in your design, and eliminates the age old problem of having to have perfect alignment of the shaft and its drive or driven unit in order to make a connection. Flexible Shafts are simply curved towards the unit and connected by means of a ferrule, or an end fitting. If you have any application, now or in the future, which will require control from remote places, you owe it to yourself to write F. W. Stewart Corporation, 4311 Ravenswood Ave., Chicago 13, Illinois, for complete information on Circle Ess Flexible Shafting.

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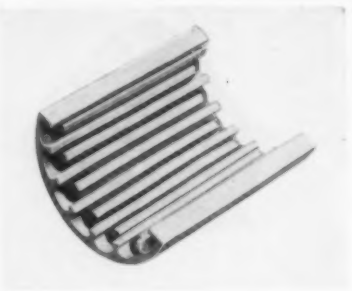

Electric heating units . . .

flat and semi-cylindrical in a wide range of sizes are offered in two temperature ranges, 1800 and 2200 F max. Flat units may be used as a flat heating surface or grouped to form an enclosed heating chamber. Coils may be exposed or muffled, depending on application. Semi-cylindrical units are for heating straight lengths of pipe or tubing. Can be arranged to surround a pipe or to apply heat under a curved surface. Available in 29 standard sizes. Wattage ratings range from 210 to 3750 w, depending on temperature range, shape, dimensions. **Hevi-Duty Electric Co., Milwaukee 1.**

Circle 27, Reader Service Card

Plunger-operated switch . . .

controls non-inductive loads to 15 amp, 115 to 230 v ac; ½ hp motors on 115 v ac and ¾ hp on 230 v ac. Contacts are SPDT. Enclosed in a die-cast aluminum housing, tapped for ½ in. IPT. Available with elastomer seal around actuating plunger. Unsealed plunger requires 30 oz max actuating force; sealed plunger, 34 oz. Release force for unsealed switch is 18 oz max; for sealed, 22 oz. Side-mounting unit is 1 x 3 x 2¼ in. Shipping weight is 6 oz. **General Controls Co., 8072 McCormick Blvd., Skokie, Ill.**

Circle 28, Reader Service Card

Conductive metallic paint . . .

is made with silver flakes, having diameters 50 times their thickness, which overlap to form a larger area of contact. Withstands high temperatures without oxidizing. Paint is said to be suitable for ceramics, titanates, glass, mica and other inorganic materials in a range of firing temperatures to 1700 F. Finely divided glass particles in paint melt to bond flakes firmly to base material. Paint is said to be equally practical for air dried or baked coating on plastics, paper or other organic materials. **Western Gold and Platinum Co., Belmont, Calif.**

Circle 29, Reader Service Card

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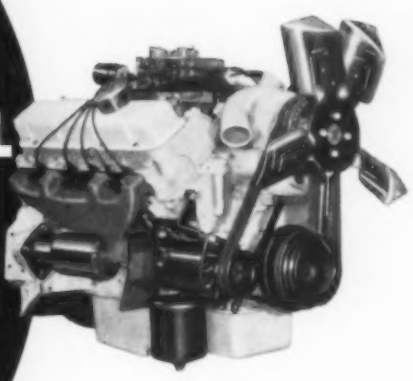

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NEW LITERATURE

The Computer and the Brain

JOHN von NEUMANN, *Silliman Lecturer for 1956, Yale University Press, New Haven, Conn. 5¼ x 8¼, 82 pp. $4.*

Author von Neumann, known in engineering for his contributions to theoretical hydrodynamics, headed up the design and construction of an experimental electronic computer after World War II that has become a sort of pilot model for similar computers all over the USA.

Many of these principles were based on von Neumann's study of the human brain, and involved the study of neurology, psychiatry and physiology. The author delivered talks at that time on the possibilities of applying available information and theory on the construction and operation of the human brain to the design of man-made computing equipment. This material forms the basis of the 1956 Silliman Lectures, annually delivered at Yale by an established scientist. Von Neumann's work on the lectures was interrupted by his death. As a result, much of the material is fragmentary.

This does not diminish the provocative and rewarding nature of the questions raised by the author and his own answers–although as von Neumann points out in his introduction, "what I am attempting here . . . is merely a somewhat systematized set of speculations . . . on the human nervous system from the mathematician's point of view"

Von Neumann suggests that the processes by which the nervous system operate change their character repeatedly from digital to analog, and back to digital–using these terms, of course, as the computer designer does.

In discussing comparative accuracy of the natural and artificial systems, von Neumann observes that the trains of periodic nerve pulses on which the operation of the brain is based is inherently more subject to error–and the compounding of them in long and complicated mathematical procedures. In fact, von Neumann concludes that the language of the human brain is definitely not that of mathematics.

One cannot read this book without speculating on where the author's next steps in his study of the brain and nervous system would have taken him. At least one conclusion is inescapable: von Neumann would eventually have encountered the necessity of defining and explaining the phenomenon of the human intellect and intelligence. Perhaps the next significant advances in automata for computation and thought await such psysiological and philosophical discoveries. –JK

Measuring Human Effort

Development of a "physiological work cycle" to replace the presently widely applied concept of a "mechanical work cycle" is proposed. Such a system should give a more accurate picture of the effort required of a worker for specific tasks and would provide quantitative data for estimating the onset of fatigue.

Abstracted from "Measuring Human Effort," Lucien Brouha, E. I. duPont de Nemours & Co., Mechanical Engineering, June 1958, 29 W. 39 St., New York 18.

CONTINUOUS MILLING PROCESS–Booklet, 8 pp, describes process and a new sculpture milling technique. With application information. Precision Shapes, Inc., Suffern 2, N. Y.

Circle 1, Reader Service Card

CHEMICAL MILLING OF CAST PARTS–Design bulletin 7, 6 pp, part of a continuing series, describes advances made recently in the art of chemically milling castings. Includes tolerances attainable, suitability, over-all and controlled area reduction, surface finishes that can be expected. United States Chemical Milling Corp., 1700 Rosecrans Ave., Manhattan Beach, Calif.

Circle 2, Reader Service Card

IMPACT EXTRUSIONS–Manual, 12 pp, offers engineering data on metalworking process. Describe advantages, covers design considerations, methods of producing and examples of extruded parts. Technical data on alloy selection, chemical composition and mechanical properties of alloys, dimensional tolerances on round and rectangular shells are included. Mueller Brass Co., Port Huron, Mich.

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DESIGN IDEAS FOR LIGHTING–Sketchbook, 24 pp, offers 60 ideas for incorporating lighting into products. Classified listing of lamps suitable for various applications includes data on ability to withstand vibration, shock, temperature and moisture. General Electric Co., Large Lamp Dept., Nela Park, Cleveland 12.

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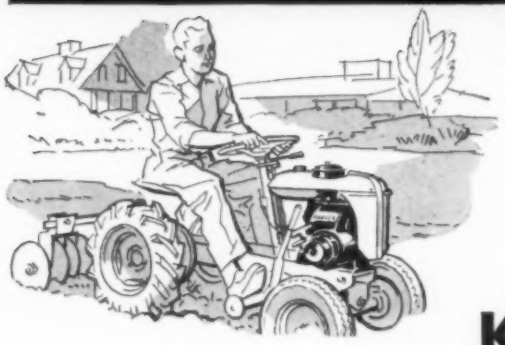

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Publisher's Postscript...

ENGINEERS have broad interests

During the month of June two reports prepared by our Department of Economics were mentioned in this column—one entitled BUSINESS PLANS and the other, the AMERICAN ECONOMY. We offered to send one or both of these reports to any reader who would like to have them. These are not engineering reports. They deal entirely with the growth of the nation's economy. We expected a modest number of requests for copies.

But you really surprised us. As this is being written, we have already put 2,945 copies of one or the other report into the mail, and requests are still coming in at the rate of 40 to 50 per day. This response clearly indicates that engineers engaged in product design and development have very broad interests. You want to know more about anything that might have some bearing on the future, whether it be engineering, scientific, or economic.

The editors have long recognized this interest. That's why we publish two editions of PRODUCT ENGINEERING: (1) The *Design Edition*, published every other week, to keep you up to date on the best product design fundamentals and practice, and (2) this *R & D Edition* to provide you with the color and the significant news of what's going on in product design and development wherever it is happening. We are trying to give you a well-rounded editorial service to keep you fully posted and to save you reading time.

We hope to offer in the months ahead through this column other reports that we believe will interest you, but which do not readily lend themselves to publication in either edition. And you'll be able to order them very easily by just using the reader service card on the facing page.

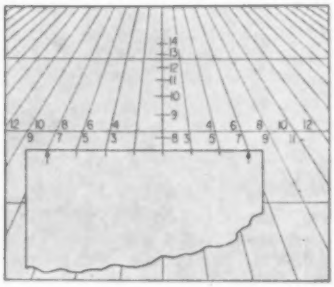
Incidentally, you've probably seen the notices the editors have put in several places in both editions about the new INDEX of the editorial content of all issues published in the first 6 months of this year. This index lists all articles under subject headings, and also all companies or organizations mentioned in articles or news items. It also contains an author's index.

The index is a handy thing to have at your elbow when you're looking for information. It's free—just write *Index Vol. 29* in the space marked "Special Data" on the reader service card on the facing page, fill in your name and address, and mail. There are still some copies of the index for the last 6 months of 1957 available. If you haven't already ordered one simply add *Index Vol 28* in the same place. Copies will be sent as long as they last.

—A. H.

For Your Information (personal)

Divisions a la chart



Want to divide a line into 7 equal parts . . . or 13 . . . or 28? This little patented gadget is designed to do it for you pronto. Arrows in the illustration point, for example, to ends of a line that Space-O-Graph — a flexible, transparent templet—sliced into 7 parts. You just move the line until its ends coincide with the proper diagonal division markers on each side, and the job is done. The device, 8½ x 10 in., can also be used for arcs and polygons. Address: Box 25562, Los Angeles 25. Price: $1.85.

Traveling notes

Stick your radio in your ear, put your record-player in your pocket, and you should have music wherever you go. That, at least, seems to be the aim of European designers. The in-the-ear radio is a German development (*PE—Feb. 24, p. 12*). Now, the British have come up with a portable record player "small enough to fit into a coat pocket but able to play a regular 12-in. LP record." What you have here is a battery-operated dc drive that mounts at the center of the record, a pickup, a transistorized amplifier, and a speaker—all in a package 4 by 8 by 1 in. There's no turntable. The record simply fits between the upper and lower lids of the case. Camp Bird Group, 39 Dover Street, London, W. 1, sells it.

For junior engineers

Build-your-own kit from Germany features bearings, pulleys, coils, linkages and counterweights that give the "Young Technician" mastery of some basics in physics. With the kit he builds his own drive mechanisms, using water, air, and steam power. Kosmos Frank'sche Verlagshandlung makes it. US representative: Ercona Corp., Electronics Div., 551 Fifth Ave., New York 17. Price: $19.95. Also available: a kit for "Young Electricians," priced at $14.95.

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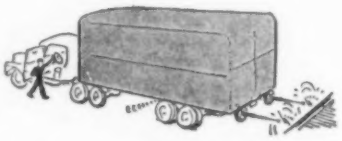
WHY DON'T THEY RESEARCH and DEVELOP...



. . . an automatic brake actuator to be placed at the rear of large trucks and semitrailers. The brakes would be automatically applied at the contact of actuator and loading dock.

—B. E. Williams

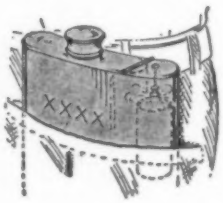
. . . a drawing compass with a tiny, rubber suction cup or some sort of adhesive to permit draftsmen to draw circles without piercing the paper. A hard working surface, like glass, could then be used under the tracing paper, resulting in a much sharper drawing line with less wear on pencil lead.

—R. J. Reichert

. . . a hand-held tape dispenser for pressure-sensitive plastic tapes. Table models waste motion and the loose tape never goes exactly where you want it. —H. Koslow

. . . an ultra-high-speed TV tape recorder for dynamic machine study. An industrial TV camera would feed into the tape recorder. By playing the tape back at slow speed a slow-motion picture could be studied on a conventional TV set.

—A. E. Newton



. . . a picnic jug or can with a compartment for a disposable compressed-gas cartridge. Release of the gas would rapidly cool the contents just before use. —H. L. Lander

Have you a pet project but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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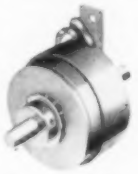
Electric Motion Control IDEAS from Warner

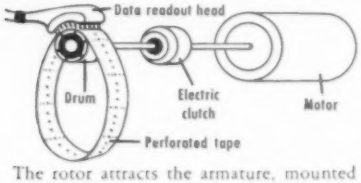
New ways to improve products with electric brakes and clutches

Quick-acting power link for tape-indexing drum



PROBLEM: To index a feed drum one frame of ten lines so a readout head with wire-mesh fingers can detect 80 signals simultaneously from tape perforations. Fingers drop through perforations and contact the silver-plated drum, supplying 60 to 100 bits per step for rapid readout.

Power is from a continuously running motor through a Warner stationary-field electric clutch-coupling. An electronic control unit energizes the clutch field with a 10-millisecond pulse for each 60-deg index. When the clutch is energized, flux flows from the field (stationary-mounted) to the rotor, which is keyed to the drive shaft.



The rotor attracts the armature, mounted on a spline-drive hub to the driven shaft, powering the paper feed drum. Drum rotation never reaches motor speed. Driving occurs in a slipping condition.

Complete 60° index in 30 ms

The Warner clutch is in the plate circuit of a type 6BG6 tube and is energized for about 10 ms. Parts are accelerated for about 9.5 ms at a torque of about 8 in.-lb. The drum reaches 490 rpm max. for each index.

To build up current in the clutch field, engage the armature and rotor, and start rotation of the drum, requires only .5 ms.

Friction in the clutch is between the rotor and the armature, either of which can be replaced in a few minutes without disturbing the electrical connections. The armature floats axially on a splined hub, providing automatic wear take-up.

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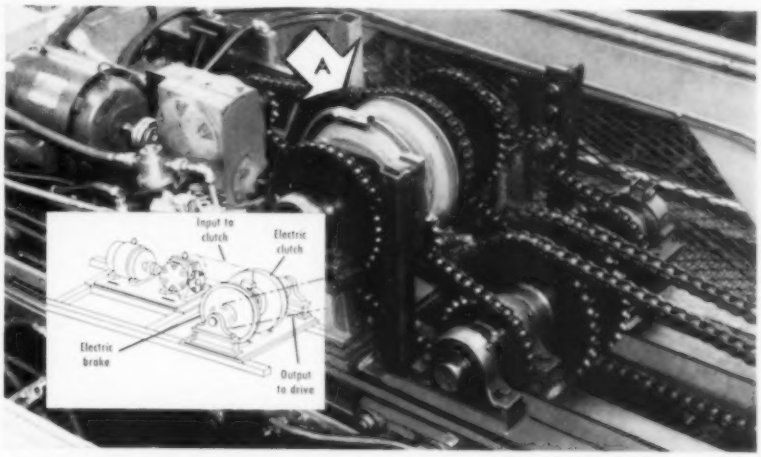


Electric clutch-brakes pass automation torture-test

A large automotive plant standardized its power drives for automation equipment, using Warner electric brakes and clutches for actuating motions at duty cycles up to 600 per hr. Purpose was to: (1) reduce peak period air consumption; (2) provide an accurate method of positioning work in automatic machinery; and (3) reduce maintenance costs. Proof of reliability is the fact that *no maintenance* has been required on 150 Warner units used for two years in this plant for applications like the one illustrated above—a straight-through drive, with right-angle jackshaft and clutch-brake (A) to actuate and position a work-elevating device.

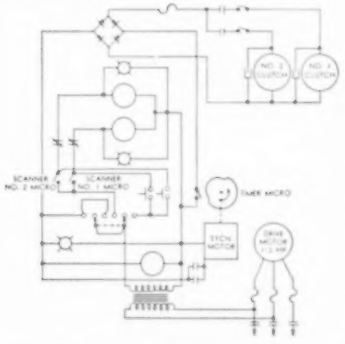
Simplify to save

Fast, precise Warner electric brakes and clutches were not only the control answer for single-revolution cycling of automation equipment, their simple, compact design adapted well to all types of right-angle and straight-through mounting arrangements. They operate at high-duty cycles without heating up—no replacement parts have been required in two years of operation.

Another advantage is speed. Warner units require only 30 watts of d-c to energize the magnets and they release instantly when de-energized. This permits rapid switching from brake to clutch, and vice versa. Complex mechanical linkages and piping are eliminated and the only outside connection required when changing setups at this plant is an electrical plug into the control panel.

Torque adjustment like tuning a radio

Some automation drives require precise actuation, such as when loaders carry steel sheet under the forming dies. Packaged Warner controls (above) permit adjustment of torque build-up so the machinery delivers parts at correct speed for foolproof, automatic production.



Air Scanners Control Clutches

The electrical schematic shows how a printing press manufacturer solved a feed-through problem with two Warner electric clutch-couplings. They operate in opposite directions to drive a tilting bar which makes the running web of the press drift left or right, depending on the direction of tilt. When the roller tilts, the web creeps to the high side. Control is actuated by compressed air aimed at microswitches on either side of the web. In normal operation, the web blocks air to both switches; but, when it drifts, it uncovers a switch to be actuated by the air blast. This starts the drive and centers the web.

Send for more IDEAS

Write for factual application sheets showing how machines can be made more productive, easier to control, simpler to maintain with Warner electric brakes and clutches.

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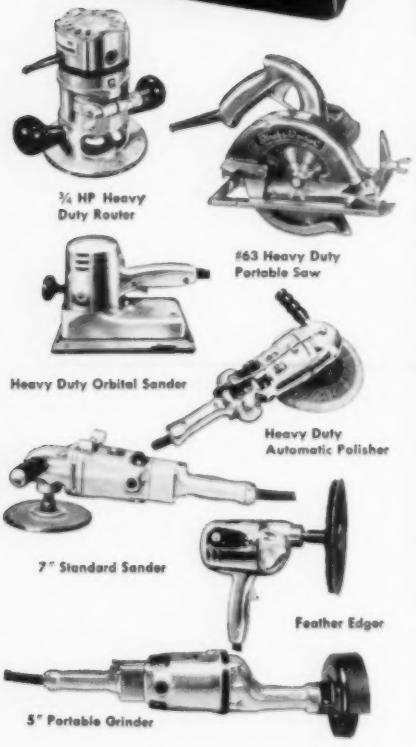

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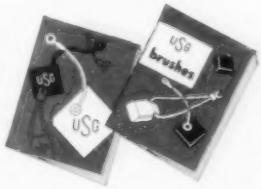
Write for catalog B-56 and the USG grade list. Most of the information necessary to design engineers is contained in these two books.



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